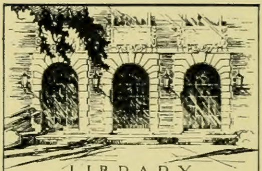

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ENGLISH BOTANY;

OR,

COLOURED FIGURES

OF

BRITISH PLANTS.

Third Edition.

ENLARGED, RE-ARRANGED ACCORDING TO THE NATURAL ORDERS
AND ENTIRELY REVISED.

WITH DESCRIPTIONS BY

JOHN T. BOSWELL, LL.D., F.L.S., ETC.,

AND

N. E. BROWN,
Of the Royal Herbarium, Kew,

THE FIGURES BY W. H. FITCH, N. E. BROWN,

AND

JOHN EDWARD SOWERBY,
Illustrator of the "Wild Flowers Worth Notice," &c. &c.

VOLUME XII.

CRYPTOGAMIA.
MARSILIACEÆ TO CHARACEÆ.—GENERAL INDEX.

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PUBLISHERS' NOTE.

The following Volume, containing the descriptions of British Cryptogamous Plants, completes the 3rd Edition of 'English Botany' within the limits proposed by its Editor, Mr. Boswell (Syme), with the exception of such supplementary and additional matter as the progress of time since its publication has rendered necessary. Unfortunately, the failure of Mr. Boswell's health prevented him from finishing his work, and its completion is due to Mr. N. E. Brown, of the Royal Herbarium, Kew, who had previously undertaken the drawings of some of the plants, and has ably supplemented the incomplete descriptions.

He has also undertaken the arduous work of revising the Latin Indices of the several Volumes which now, incorporated with the English indices, and with a new one of French and German names, furnish for the first time a complete Index to the whole work.

ENGLISH BOTANY.

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Volume I.

Ranunculaceæ, Berberidaceæ, Nymphæaceæ, Papaveraceæ, and Cruciferæ.

Volume II.

Resedaceæ, Cistaceæ, Violaceæ, Droseraceæ, Polygalaceæ, Frankeniaceæ, Carophyllaceæ, Portulacaceæ, Tamariscaceæ, Elatinaceæ, Hypericaceæ, Malvaceæ, Tiliaceæ, Linaceæ, Geraniaceæ, Ilicineæ, Celastraceæ, Rhamnaceæ, Sapindaceæ.

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Volume V.

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Volume VI.

Campanulaceæ, Ericaceæ, Jasminaceæ, Apocynaceæ, Gentianaceæ, Polemoniaceæ, Convolvulaceæ, Solanaceæ, Scrophulariaceæ, Orobanchaceæ, and Verbenaceæ.

Volume VII.

Labiatæ, Boraginaceæ, Lentibulariaceæ, Primulaceæ, Plumbaginaceæ, Plantaginaceæ, Paronychiaceæ, and Amarantaceæ.

Volume VIII.

Chenopodiaceæ, Polygonaceæ, Eleganaceæ, Thymelaceæ, Santalaceæ, Aristolochiaceæ, Empetraceæ, Euphorbiaceæ, Callitrichaceæ, Ceratophyllaceæ, Urticaceæ, Amentiferæ, and Coniferæ.

Volume IX.

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Marsiliaceæ, Isoetaceæ, Selaginellaceæ, Lycopodiaceæ, Ophioglossaceæ, Filices, Equisetaceæ, and Characeæ, General Index.

[ERRATA OF VOLUME XII.

PAGE	LINE	
110	7	For p. 622, read p. 602.
112	35	For Plates 1871, 1872; read Plates 1870, 1871.
115	25	After ATHYRIUM FLEXILE, add *Syme*; and beneath this line insert, Plate 1871.
139	25	After CETERACH OFFICINARUM, add *Desv.*
144	20	For Hurd Fern, read Hard Fern.
173	21	For Arthur Bennett, read A. W. Bennett.
177	9 & 32	After the word Brunn, strike out the comma.
178	19	
181	6	
182	13	
188	30	
189	11	
191	28	
186	13	Strike out the words Var. *a. genuina.*
186–187		Strike out N. glomerata, var. β Smithii, with the remarks referring to it, and add the synonymy to that of N. glomerata. Messrs. Groves having intimated in the *Journal of Botany*, 1885, p. 350, that they had found nucules on Mr. Borrer's Lancing specimen, induced me to re-examine it, and in a fertile head taken from another part of the specimen, I find some extremely young nucules in their first stages of development; the two heads previously examined by me were probably too young, as I could find nothing of the kind upon them, although carefully searched for under a power of 450 diameters. The var. Smithii must therefore be considered to be founded upon an immature state of N. glomerata.
189	36–40	Strike out these lines beginning at the words 'The plant,' &c., as there is a specimen of N. prolifera from the Glasnevin Canal in the Herbarium of the late Dr. D. Moore, at Dublin.
200	18	For the word but, read and.
215	2	After var. ? β. connivens, add *N. E. Brown.*
217	31	After the words 'beneath the nucule' add—? (Messrs. Groves in the *Journal of Botany*, 1885, p. 350, state that this is *not* the case in their specimen, but do not say how they are situated. As this is the normal position of the globules in the group to which this species belongs, a further discovery of monœcious specimens may possibly prove Messrs. Groves' example to be abnormal.)

PLATE	
1826*	For Isoetes eu-lacustris, var. Morei, read Isoetis lacustris, var. Morei.
1827	For Poetes echinospora, read Isoetes echinospora.
1871	For Athyrium alpestre, var. flexile, read Athyrium flexile.
1897	Strike out the words var. Wilsoni.

N. E. Brown.]

ENGLISH BOTANY.

SUBKINGDOM II.

CRYPTOGAMIA, OR FLOWERLESS PLANTS.

PLANTS destitute of flowers furnished with special organs of reproduction (stamens and pistils), but producing spores, which differ from seeds in containing no embryo previous to germination. The plants have, however, at some period of their growth, bodies which represent the male and female organs of flowering plants, which are so various that they must be described under each separate Class or Order.

CLASS I.—**VASCULARES.**

Herbs, usually perennial, very rarely annual, rarely trees, which have a stem composed of cellular tissue in which are imbedded closed fibro-vascular bundles, the whole covered by an epidermis, producing adventitious roots and leaves, or representatives of leaves with various venation. Spores produced without fertilisation, included in spore cases which are either enclosed in sporocarps (modified leaves), or naked in the axils of the leaves or on the back of the leaves, or on the under side of peltate hexagonal plates collected into a terminal cone. Male and female organs produced on a prothallium, which is the result of the germination of the spore. The prothallium is sometimes simply a growth of cellular tissue which protrudes from the spores after the latter have burst, but in other cases it grows out into a scale resembling a Liverwort, and has an independent existence sometimes lasting for months. In either case, the female organs (*archegonia*) are formed in the prothallium, their essential part consisting of a cell (*oosphere*), enclosed in the tissue of the prothallium, and having an open protruding neck: the male organs consist of spiral ciliated threads (*antherozoids*), produced from cells (*antheridia*), either formed upon or in the prothallium or contained in separate spores from those which produce the prothallium which developes the archegonia.

ORDER LXXXIX.—**MARSILIACEÆ.**

Aquatic or marsh plants with creeping rooting branched rootstocks. Leaves alternate, erect, filiform, without any lamina, or with a lamina composed of 4 equal, obovate, entire or retuse leaflets; in either case with circinate vernation. Sporangia contained in capsules or sporocarps, subsessile in the axils of the leaves or more or less longly stalked and springing from the lower part of the leaf, globular or ovoid, often hairy at least when young, 2- to 4-celled vertically, 2- to 4-valved. Spores of two kinds, the larger (*macrospores*) solitary in each macrosporangium, the smaller (*microspores*) numerous in each microsporangium. Macrosporangia and microsporangia included in the same sporocarp. Prothallium developed from a papilla at the apex of the macrospore; its oosphere, after being fertilised by the antherozoids discharged from the microspores, developes and forms the new plant.

GENUS I.—**PILULARIA.** *Linn.*

Sporocarps subglobular subsessile and erect, or shortly stalked and bent down, 2- or 4-celled, 2- or 4-valved at the apex.

Aquatic herbs, with slender branched creeping stems and setaceous leaves without any lamina.

Name derived from *pilula*, a pill, which the sporocarps resemble.

SPECIES I.—**PILULARIA GLOBULIFERA.** *Linn.*

PLATE 1825.

Rabenhorst, Cryptogamæ Vasculares Europeæ Exsiccatæ, No. 27.

Sporocarps subglobose, 4-celled, 4-valved, 3 or 4 times longer than their peduncle, erect. Macrospores numerous, ovoid, constricted in the middle. Microspores without a gelatinous covering.

On the margins of lakes and ponds, usually in shallow water, but left growing in the damp mud in summer. The Rev. W. W. Spicer says, that in September he found it in a pond near Guildford, Surrey, in water 40 inches deep. (Phyt. 1851, p. 350.)

Rather sparingly but generally distributed from Cornwall and Sussex, northwards to Skye and Sutherland. Rare in Ireland, where it has been noticed in the west, and more plentifully in the north-east.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Rootstock long, creeping, filiform, sparingly branched, glabrous except at the growing apex, which is clothed with hairs, producing 1 or more adventitious roots at each point from which leaves are given off. Leaves 1 to 4 inches long, 2 to 4 together at intervals along the rootstock, erect, deep green, smooth, with a few very minute hairs or papillæ, the young ones coiled up at the apex like the fronds of a Fern. Sporocarps solitary in the axils of the leaves, very shortly stalked, globose, slightly pointed, resembling small peppercorns, at first hairy, at length glabrous, divided parallel to the axis into 4 cells, with a parietal placenta running down each; to this placenta the sporangia are attached, forming a sorus. Lower sporangia in each sorus a dozen or more, each containing a single macrospore; uppermost sporangia of the sorus containing numerous microspores: in either case the sporangia are small thin hyaline walled sacs which eventually burst and discharge their spores, which escape enveloped in the jelly which fills the sporangia, and by its expansion causes their rupture. Ripe microspores enveloped in a gelatinous coat, furnished with a small projection at the apex, formed by the protrusion of the inner layer of the spore, which is torn into shreds. Underneath all this there is a collection of protoplasm, from which is developed the prothallium; for the details of this, see Hoffmeister on the Higher Cryptogamia, translated by Currie, pp. 318 to 324.

Pillwort, or Pepper-grass.

ORDER XC.—**ISOETACEÆ.**

Aquatic or terrestrial plants consisting of a fleshy depressed 2- to 4-lobed corm, producing simple or forked root-fibres, and giving rise to rush-like leaves with dilated bases, which are sometimes persistent. Leaves subulate or linear, containing 4 air-tubes, with transverse partitions, furnished with stomata in some species. Sporangia solitary, immersed in the inner face of the dilated base of the leaves to which they are connected by their backs, crossed internally by threads affixed to their upper and under sides; the sporangia of the outer leaves containing numerous macrospores, those of the inner leaves containing very numerous microspores. Some species have *phyllodes*, or barren leaves, on the corm between the leaves bearing macrosporangia and those bearing microsporangia. Macrospores large, with a whitish crustaceous integument, subglobular, trigonous towards the apex, the division between the hemispherical and the trigonous portion, and those between the three faces of the trigonous part marked by elevated lines, the trigonous portion ultimately opening into three valves. Microspores very numerous and very minute, grey, oblong-trigonous, marked by a single line. Macrospore developing a prothallium at its apex, which has its oosphere fertilised by the antherozoids developed in the microspores, as in the Marsiliaceæ.

GENUS I.—**ISOETES.** *Linn.*

The only genus. Characters the same as those of the Order.

Name from ἴσος (*isos*), equal, and ἔτος (*etos*), year, from the plant having the same appearance all the year round.

SPECIES I.—**ISOETES LACUSTRIS.** *Linn.*

PLATES 1826 and 1827.

Plant aquatic, submerged. Roots glabrous. Corm 2-lobed, not clothed with the persistent and hardened bases of former leaves. Leaves subcylindrical or tetragonous, subulate, with broad sheathing bases having membranous edges and smooth backs, straight or recurved, erect or ascending, more or less translucent, without marginal bast-fibres, and without stomata or with very few. Phyllodes absent. Velum incomplete. Sporangia oblong-ovoid oval-ovoid or subglobose, unspotted. Macrospores with a white crustaceous integument, tuberculate, with the tubercles not coalescing into ridges. Microspores smooth.

SUBSPECIES I.—**Isoetes eu-lacustris.**

PLATE 1826.

Rabenh. Crypt. Vasc. Europ. Nos. 5 and 77.
I. lacustris, *Durieu* et Auct. plur. *Bab.* Man. Brit. Bot. ed. vii. p. 456. *Milde*, Filices Europ. p. 276.

Plant aquatic, submerged. Root-fibres glabrous. Corm 2-lobed, with 3 to 7 longitudinal furrows, not clothed with the persistent and hardened bases of former leaves. Leaves slightly translucent, dark green, subcylindrical-terete or subulate, with broad sheathing bases having membranous margins and smooth backs, erect or ascending, straight or recurved, without marginal bast-fibres, and without stomata or with very few. Phyllodes absent. Velum incomplete. Sporangia oblong-ovoid or subglobose, unspotted. Macrospores with a white crustaceous integument, tuberculate with prominent blunt or truncated tubercles, which are not higher than broad.

Var. α. *genuina.*

PLATE 1826.

Leaves rarely exceeding 6 or 7 inches in length, stout, more or less recurved when the plants are not crowded; the membranous margins usually rather narrower than the firm portion of the leaf-base.

Var. β. *Morei.*

PLATE 1826*.

I. Morei, *D. Moore* in Journal of Botany (1878), p. 353.

Leaves 1 to 2 feet long or more; more slender and more tapering than in var. α, erect, or with the apices floating; the membranous margins usually as broad as the firm portion of the leaf-base. Macrospores in more saccate cavities, and fewer in number, and microspores smaller than in var. α.

Var. α occurs in lakes, growing submerged in the water, almost confined to hilly districts. In Wales it is frequent in Carnarvonshire, and occurs also in Merioneth and Denbigh. Frequent in the Lake district. In Scotland it occurs in most of the counties from the Forth and Clyde north to Caithness and Sutherland. Dr. A. R. Duguid found it in Loch of Carness, Orkney. In Ireland it occurs from north to south, chiefly in mountainous districts, and most plentiful in the west and north.

Var. β is found wholly submerged, or with the leaves floating on the water, in the Upper Lough of Bray, Co. Wicklow.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Corm from the size of a cherry-stone to that of a hazel-nut, dark brown exteriorly, white when cut through. Root-fibres developed from the furrow which traverses the bottom of the corm, simple or once or twice forked towards the apex, brown. Leaves 2 inches to 1 foot long, deep green, rather rigid, tapering, usually recurved and diverging or erect; their bases dilated, with membranous pale yellow edges, withering and ultimately rotting off from the corm without becoming hard; bases of the lowest leaves containing macrosporangia, and the upper ones microsporangia. Sporangia ovoid, about the size of wheat or barley grains, immersed in the substance of the leaf to which they are attached by the back, and more or less covered by a membranous outgrowth from the margin of the fovea or depression in the leaf termed the *velum*. Immediately above the fovea which contains the sporangium, there is a transverse pit in the leaf termed the *foveola*. The margin of this foveola nearest the sporangium is elevated, and forms the *labium*, and from the bottom of the pit there rises a membranous scale (*lingule*), attached by a broad base and acuminated upwards. Macrospores $\frac{1}{60}$ inch in diameter, furnished with prominent tubercles whose height does not exceed the breadth of their base. The prothallium is formed at the apex of the macrospore, and eventually ruptures it, the macrospore opening by 3 sutures corresponding with the converging lines at the apex.

Var. β is a very remarkable form, and may be a distinct subspecies, as which Dr. D. Moore has described it; and in this view of it he is supported by the authority of Prof. Caruel of Pisa, Prof. Duval-Jeune and Martius of Montpellier, and Dr. Ascherson of Berlin, who all consider it distinct from any described species.

It is with great reluctance that I express an opinion different from that of such great authorities, especially as I have not had an opportunity of seeing the plant in a recent state; but the most careful comparison of the specimens of I. Morei (which the late Dr. Moore has kindly sent me) with those of genuine I. eu-lacustris leads me to the conclusion that it is impossible to separate it even as a subspecies. From the time of Dillenius it has been known that there are two forms of Isoetes eu-lacustris, found growing in the same places, viz. a solitary form in which the leaves are thicker, shorter spreading, and more or less recurved, and another form, var. β, *Smith* (Calamaria folio longiore et graciliore, *Dill.*), a gregarious form, in which the leaves are flaccid, longer, more slender, and more brittle. Modern British authors regard these as states, and not varieties of the plant. Smith advanced the untenable hypothesis that the tall and slender variety might perhaps "be caused by those sudden risings of the waters so frequent in mountainous countries." But as the stout recurved-leaved plants grow in the same lake as the others, this is evidently a fallacious idea. Mr. E. Newman no doubt has pointed out the true cause of the variation of the plant, viz. that many of the spores "remain in the capsule and there germinate, throwing up dense tufts of slender leaves of a delicate green colour. I am indebted to Miss Beever for specimens which beautifully exhibit this germination of the seeds in situ, the parent plant and its offspring having been dried while in the most favourable state for displaying this peculiarity, to which Miss Beever particularly called my attention. These young plants rapidly increase in size, send their roots downwards into the earth, and their leaves upwards into the water; and from the crowding incident on this condition of the seedling plants the elongate and slender leaves would naturally result." (Hist. Brit. Ferns, ed. ii. p. 392.) *

Every one who has gathered I. eu-lacustris must be familiar with this form, and to my eyes I. Morei seems to be merely a greatly developed state of this crowded form of I. eu-lacustris. No doubt, as Dr. Moore says, in habit it resembles I. setacea *Delille*, and I. velata *A. Braun*, but in the structure of the corm, of the leaves, and of the velum it differs from these plants, and agrees perfectly with I. eu-lacustris; for both I. setacea and I. velata have the leaves furnished with 6 peripherical bast-fibres.

Dr. Moore says it differs from I. eu-lacustris "in the veil which covers the macrosporangia being one-half longer, leaving only one-third of the spores naked;" but according to my experience the velum in I. eu-lacustris does usually leave only one-third of the spores naked. The macrospores seem quite similar in vars. α and β.

Attention was called to this remarkable form by Mr. A. G. More in 1871, but it was not until November 1876 that Dr. Moore obtained living specimens. These and some of the ordinary state he found retained their respective character in cultivation.

Lake Quillwort.

SUBSPECIES II.—**Isoetes echinospora.** *Durieu.*

PLATE 1827.

Rabenh. Crypt. Vasc. Europ. Ex. No. 76. *Bab.* Journ. Bot. 1863, p. 1. *Milde*, Filices Europ. p. 279.

Plant aquatic, submerged. Root-fibres glabrous. Corm 2-lobed without longitudinal furrows, not clothed with the persistent and hardened bases of former leaves. Leaves pellucid, pale green, subcylindrical-terete or -subulate, with broad sheathing bases having membranous margins and smooth backs, ascending, straight, without marginal bast-fibres, and without stomata (in the European plant). Phyllodes absent. Velum incomplete. Sporangia subglobose oval-ovoid. Macrosporangia with a white crustaceous integument, muricate with very prominent acute spine-like tubercles, which are higher than broad.

In lakes in mountainous districts "where there is peat at the bottom of the water." In a pool near Llyn-y-cwm near Llanberis (Mr. W. Wilson); and in the river that runs out of the lakes of

---

* Since the above was written I have seen Mr. Baker's monograph of the genus in the 'Journal of Botany,' 1880, pp. 65 *et seq.* He considers I. Morei a form of I. lacustris.

Llanberis, Carnarvon (Professor Babington). In a pool near the top of Ben-Voirlich, Dumbarton (Professor Babington, 1845). Loch of Drum, Aberdeenshire (where I gathered it in 1850). Loch Callater, Braemar (Mr. J. Sadler in 1878). Lake near the Gap of Dunloe, Killarney, and in the upper lake of Killarney, near Glenagh (Dr. Moore). Lough Gowla-na-gower and Lough na-Grooaun, Inish Boffan, Galway (Mr. A. G. More).

England, Scotland, Ireland. Perennial. Summer, Autumn.

Very similar to I. eu-lacustris, but according to Professor Babington the plants may be distinguished when growing by the "spreading leaves and pale green colour," in contrast "with the dark tint and usually erect leaves of I. eu-lacustris." The only place where I have collected this plant is in the Loch of Drum in 1850 and 1851. There the fronds are 2 to 6 inches long, spreading, flaccid, fragile, pellucid, pale green, with a large portion of the base paler: but the North American form, var. Braunii, is described by Dr. Engelmann as having the "leaves dark, and often olive-green, straight or commonly recurved," while another American variety Boothii has bright green stiffly-erect leaves. Both these American forms have stomata on the leaves, which, so far as I know, have not been observed in any European specimens, except some from 'Iceland' (Milde). The threads in the interior of the sporangia are more thickened, but the only conspicuous difference between the subspecies is that the tubercles on the macrospores of I. echinospora are very much longer and more acute than in I. eu-lacustris.

Probably the plant will be found in other stations, having been passed over as I. eu-lacustris.

Prickly-spored Lake Quillwort.

SPECIES II.—**ISOETES HYSTRIX.** *Durieu.*

PLATE 1828.

Rabenh. **Crypt. Vasc. Europ. Nos. 101, 102, and 103.**
I. Duriæi, *Hook.* Brit. Ferns, tab. 26 (non Bory).

Plant terrestrial. Roots pubescent. Corm 3-lobed, with 3 radiating furrows beneath, its lower part clothed with the persistent and indurated bases of former leaves. Leaves trigonous, filiform, with broad sheathing bases having membranous edges and a tuberculated band on the back, recurved and spreading in a circle, opaque, with numerous stomata. Phyllopodia or indurated bases of the leaves crustaceous, pitchy black, 3-toothed at the apex with the central tooth often minute. Phyllodes usually present. Velum complete, wholly covering the sporangia. Macrospores with a crustaceous white integument, tuberculate, with the blunt tubercles coalescing into ridges. Microspores tuberculate.

On damp spots in sandy pastures near the sea, L'Ancresse, common in the north of Guernsey. Discovered by Mr. George Wolsey, in June, 1860.

Channel Islands. Perennial. Summer.

Corm in the Guernsey specimens I have seen about the size of a pea, enclosed in a kind of husk formed by the greatly hardened persistent bases of the former leaves, until it attains a bulk about that of a hazel-nut. The leaf scales or phyllopodia are $\frac{1}{5}$ inch long, concave, pitchy black, the uppermost ones terminated by 3 teeth not above $\frac{1}{16}$th inch long, and often shorter. The lower scales are in a decaying state, and have the teeth broken off; and sometimes the whole of the scales begin to decay as soon as they are matured by the deposition in them of dark coloured tissue. Leaves $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, deep dull green, something like those of Scilla autumnalis, strongly recurved, flattish above, and acutely convex beneath, so as to have a trigonous section, pellucid towards the base, which is greatly dilated over the sporangia, which are about the size of grains of pearl barley, and concealed by the velum. On the back of the pale enlarged leaf-base there is a band covered with small tubercles extending as far as the sporangium does. Macrospores much smaller than those of I. lacustris, and with much less prominent tubercles than even in I. eu-lacustris, and forming beaded lines, from their bases coalescing.

The above description is not that of the typical I. Hystrix. (I. Hystrix forma loricata, Rabenh. l. c. No. 101), which has persistent scales terminated by lateral spines $\frac{1}{4}$ or even $\frac{1}{2}$ inch long, with a short intermediate tooth, and a bulb from the size of a hazel-nut to that of a walnut.

The Jersey plant agrees well with I. Hystrix forma desquamata subinermis of A. Braun, Rabenh. l. c. Nos. 102 and 103 *b*.

Spiny Quillwort.

ORDER XCI.—SELAGINELLACEÆ.

Moss-like herbs or small shrubs with dichotomous or branched stems and minute entire or serrulate or denticulate leaves, either equal and regularly disposed round the stem, or bifarious and unequal, two being larger than the others and diverging right and left from the stem, while the smaller leaves are adpressed to it. Sporangia of two kinds, macrosporangia and microsporangia, which are produced in the axils of modified leaves or bracts arranged in terminal spikes. Macrosporangia often solitary in the axils of the lowest bracts of the spike, but sometimes intermingled with the microsporangia, 3- or 4-lobed, and 3- or 4-valved, containing 3 or 4 (rarely 1 to 6), comparatively large roundish angulated macrospores. Microsporangia numerous, ovoid or subglobular, containing very numerous microspores. Prothallium developed on the apex of the macrospores, and fertilised by the antherozoids escaping from the cells of the microspores as in Isoetaceæ.

GENUS I.—**SELAGINELLA.** *Spring.*

The only genus; characters the same as those of the Order.

Name a diminutive of *Selago*, *i.e.* of Lycopodium Selago.

SPECIES I.—**SELAGINELLA SELAGINOIDES.** *Gray.*

PLATE 1829.

Rabenh. Crypt. Vasc. Europ. No. 63. *Hook.* Stud. Flor. p. 471.

S. spinulosa, *A. Braun* in *Döll.* Rhein Flor. p. 38. *Bab.* Man. Brit. Bot. ed. vii. p. 458. *Milde*, Filic. Europ. p. 260. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 971. *Fries*, Summ. Veg. Scand. p. 83. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 656. *Wilkomm & Lange*, Prod. Fl. Hisp. Vol. I. p. 14.

Lycopodium selaginoides, *Linn.* Spec. Plant. ed. iii. Vol. II. p. 1565. *Smith*, Eng. Bot. ed. i. No. 1148, and Eng. Flor. Vol. IV. p. 332. *Newman*, Brit. Ferns, ed. ii. p. 371.

Stem slender, shortly creeping, sparingly branched, with the branches decumbent, ascending at the apex. Leaves all similar, pointing in all directions, spreading or ascending, strap-shaped lanceolate, very acute, remotely spinous-ciliate on the margins. Spikes erect, cylindrical or clavate, solitary at the extremities of erect branches thicker than the barren ones. Bracts spreading all round, triangular-lanceolate, much larger than the leaves on the barren shoots, and drawn out into a more acute point so as to be cuspidate, strongly spinous-ciliate, passing without any break into the leaves of the fertile branch. Macrosporangia 3- or 4-lobed, and 3- or 4-valved. Macrospores with a few scattered papillæ.

In boggy ground, especially by the sides of small streams and ditches and on wet rocks; frequent in mountainous districts, also, in the north, on sandy ground near the sea. From Carnarvon, Flint, Chester, Derby and York, north to Orkney and Shetland. Rare in the south, but frequent in the west, middle and north of Ireland.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Stem 1 to 2 inches long, rarely more. Leaves bright green, shining $\frac{1}{16}$ to $\frac{1}{10}$ inch long, with a faint midrib, and commonly with 1 or 2 projecting spine-like serratures or teeth, which however are more conspicuous in the leaves towards the apex of the branches than on those towards the base, where as well as on the stem leaves they are sometimes absent. Spike-bearing branches 1 to 4 inches high, erect from a decumbent base. The spike is from $\frac{1}{2}$ to $1\frac{1}{2}$ inch long. Bracts $\frac{1}{10}$ to $\frac{1}{6}$ inch long, broad at the base, and much more strongly spinous-ciliate and more acuminated than the leaves, at first adpressed, afterwards spreading. Macrosporangia about $\frac{1}{25}$ inch in diameter, 3-sided. Microsporangia placed in the axils of the upper branches, and smaller than the macrosporangia.

Lesser Alpine Clubmoss.

EXCLUDED SPECIES.

SELAGINELLA HELVETICA. *Link.*

A specimen of this is included in Sherard's 'Herbarium,' but without any record of locality; with it, according to the Rev. W. W. Spicer, there is a label in the form of a paragraph from Ray's 'Synopsis,' ed. iii. From this it would seem Lobel (1570) supposed it to have been gathered on the Mendip Hills, Somerset; and Merrett (1667) by the Thames side at the Neathouses and Kingsbridge, Middlesex. The last certainly an error; the former probably so. See Phyt. 1851, p. 384.

ORDER XCII.—LYCOPODIACEÆ.

Herbs or small shrubs, often with creeping woody branched or forked stems, having adventitious roots, or rarely with subterranean branches apparently performing the office of roots, in one genus with tuberous roots. Leaves small, often resembling those of Juniper, in one genus all radical and subulate. Sporangia all similar, placed in the axils of modified leaves or bracts, arranged in terminal spikes, which often resemble small cones, more rarely scattered over the upper part of the stem in the axils of the leaves, roundish or 3- or 4-lobed, 1- to 3-celled, 1- to 3-valved. Spores uniform, all extremely minute. In the only case in which germinating spores have been observed (those of Lycopodium annotinum), they had produced an irregularly lobed subterranean prothallium, destitute of chlorophyll, sparingly furnished with small root-hairs; the upper surface has numerous grooves and protuberances, in which antheridia and archegonia were found containing antherozoids. The archegonium was not observed, but the position it would occupy is indicated by the germinating plants. See Sachs' 'Text Book of Botany,' translated by Bennett and Dyer, p. 400. This agrees quite with the reproduction of Ophioglossiaceæ, with which Berkeley has pointed out their connection previous to the discovery of the prothallium mentioned above. See 'Introduction to Crypt. Botany,' p. 549.

GENUS I.—**LYCOPODIUM.** *Linn.*

Sporangia roundish-reniform, 1-celled, 2-valved; spores marked with 3 striæ.

Herbs or small shrubs, often with creeping stems or rootstocks, and small leaves like those of Juniper or Savin. Sporangia usually in terminal spikes.

Name from λύκος (*lucos*), wolf, and πούς (*pous*), foot, to which the extremity of the stem has been compared.

SPECIES I.—**LYCOPODIUM SELAGO.** *Linn.*

PLATE 1830.

Rabenh. Crypt. Vasc. Europ. No. 95.

Stem short, not creeping, decumbent at the base, repeatedly dichotomous; branches erect or ascending, approximate. Leaves all similar, inserted all round the stem, crowded, 8-farious, adpressed or spreading, lanceolate strap-shaped, acuminated and acute, pungent or sub-pungent, entire, rarely spinous-serrate. Sporangia in the axils of ordinary leaves, not collected into terminal spikes, but distributed over the greater part of the branches.

Var. α. *vulgatum.*

PLATE 1830.

Leaves imbricated, adpressed, at least on the ultimate divisions of the branches.

Var. *β. recurvum.*

Leaves spreading or reflexed, usually longer and more decidedly strap-shaped than in var. *α.*

On heaths, rocks, and barren places, chiefly on mountainous districts, although it is found over the whole of Britain from Cornwall, Devon, and Sussex north to Orkney and Shetland; but it is a scarce plant in the low-lying counties of England. Frequent and widely distributed throughout Ireland.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Stem short, or at least the rooting part of it, leafy to the base, often reddish, forking 2 to 5 times into branches from 2 to 7 inches long, very rarely a foot long; these branches rise from the procumbent part of the stem with a rather sudden curve, and when growing on rocks or beside hollows they frequently dip downwards before they ascend. Leaves $\frac{1}{10}$ to $\frac{3}{10}$ inch long, those on the lower part of the stem generally spreading or reflexed, and those in the upper part of the branches adpressed, but every intermediate form occurs between the extremes of the leaves being all adpressed, or all spreading; they are convex, beneath bright green or olive, and have no evident midrib. Generally the branches are quite continuous, but sometimes they are slightly annotinous, with slight indications of the annual growth. There is no marked division between the spikes and the branches, the leaves in the axils of which there are sporangia, being quite similar to the others. The sporangia are sometimes confined to the apex of the branches, but more usually are spread over the greater part of their erect portion. On the upper part of the stem small buds or bulbils, developed from the upper leaves, are to be found. These bulbils are formed in an irregular 6-cleft calyx-like body, developed out of the upper leaves; the bulbils consist of 5 lobes, of which 2 remain small, while the others develope into oval leaf-like bodies, ultimately at least as long as and much broader than the leaves of the plant. The bulbils appear to germinate whether they remain on the plant or fall to the ground. A detailed account of them will be found in Newman's 'British Ferns,' ed. ii. p. 378–380, and 'Phytologist' for 1844, pp. 84–86.

I have never seen British specimens of L. Selago with the leaves spinous-serrate. Milde includes under L. Selago, L. suberectum, *Lowe*, in which they are very conspicuously spinous-serrate; but this plant, from Madeira and the Azores, seems too different from L. Selago not to be separated from it at least as a subspecies, to which it has as good a claim as the North American L. lucidulum, *Michaux.*

Fir Clubmoss.

SPECIES II.—LYCOPODIUM INUNDATUM. *Linn.*

PLATE 1831.

***Rabenh.* Crypt. Vasc. Europ. No. 65.**

Stem short, creeping, prostrate, applied to, and on the under side actually imbedded in the ground, simple or very sparingly branched; branches at first ascending, afterwards prostrate. Leaves inserted all round the stem, approximate, all turned upwards and slightly falcated so as to be secund, or a few of them on the under side of the stem adpressed to it, strap-shaped linear, tapering gradually to a very acute point, not pungent nor bristle-pointed, entire. Fertile branches 1 on each stem, rarely 2 at intervals, very rarely 2 close together, erect, densely leafy. Leaves on fertile branches similar to those of the stem, but ascending or adpressed, not secund. Spike occupying from half to one-third of the upper part of the fertile branch, oblong-fusiform or clavate-cylindrical, with its bracts resembling the leaves but larger, and broader towards the base, which has usually 1 tooth or sometimes 2 teeth on each side.

On damp heaths, growing generally on peat or sand. Rather frequent and generally distributed in England, with the exception of Wales. Rare and local in Scotland, where it occurs on Tent's Muir, Fife; Inverarnon, Dumbarton; and in the counties of Perth, Forfar, Elgin, Inverness, Ross, and perhaps Kincardine. In Ireland it appears to be very scarce, but has been found in counties Cork, Kerry, and in the Connemara district of Galway.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Stem 1 to 4 inches long, attached to the soil at intervals by wiry roots. Fertile branches 1 to 4 inches high. Leaves $\frac{1}{8}$ to $\frac{1}{4}$ inch long, rather dull green, especially the older ones, not shining, with a slender midrib and a narrow hyaline margin. Spike always thicker than the fertile branch that supports it, $\frac{3}{4}$ to 2 inches long. Bracts $\frac{1}{8}$ to $\frac{3}{10}$ inch long, at first adpressed, afterwards spreading, and ultimately yellowish-olive. Sporangia transversely oval, opening near the base.

This is the only British Lycopodium in which the barren stems are annual, the basal portion dying off each year.

The American plant, called L. inundatum, is larger and stouter, with much longer and more subulate leaves, often with a few denticulations. The spike is much more conspicuous than in the European plant, and begins abruptly, and the leaves on its stalk have a tendency to be verticillate, and are more distant. Probably it ought to be considered as a distinct subspecies, and bear the name Bigelovii, which is given to the larger form of it. L. alopecuroides, *Linn.*, another North American form, seems no more than a subspecies, with the leaves conspicuously ciliate, especially towards the base: the whole plant is much larger than L. inundatum.

Marsh Club-moss.

SPECIES III.—LYCOPODIUM ANNOTINUM. *Linn.*

PLATE 1832.

***Rabenh.* Crypt. Vasc. Europ. No. 67.**
L. juniperifolium, *DC.* Fl. Fr. Vol. IV. p. 572.

Stem very long, creeping, prostrate, much branched; branches ascending or erect, unbranched or irregularly once or twice dichotomous. Leaves inserted all round the stem, rather distant, most of them turned upwards and slightly falcate so as to be subsecund; those the under side of the stem mostly adpressed to it, lanceolate strap-shaped, acute, not piliferous, entire or faintly denticulate; leaves on the branches 5-farious, crowded, ascending or spreading or slightly reflexed, decurrent, linear strap-shaped or narrowly elliptical-strap-shaped, acuminated and acute, pungent, remotely serrated, with callous points; those at the termination of each year's growth smaller and adpressed, which gives the branches the appearance of being constricted at intervals. Spikes oblong-cylindrical, subobtuse, terminating some of the branches. Bracts yellow, deltoid-ovate or roundish, abruptly acuminated so as to be cuspidate with the cusp frequently drawn out into a long point, cordate at the base, finely denticulate on the margins.

On heaths in mountainous districts. Rather local. On Glyder Fawr above Flyn-y-cwm, Carnarvonshire; Charnwood Forest, Leicestershire; Lake district. In the Scotch highlands it is more common, occurring on the Breadalbane, Clova, Braemar, and Inverness mountains. It is reported from Goatfell in Arran, and I have collected it in the south of Mull at an elevation which from recollection I should estimate at about 50 yards. In Orkney it occurs in Berridale, Hoy, and I believe in Ronsay.

England, Scotland. Perennial. Summer, Autumn.

Stem 1 or more yards long, tough, wiry, flexuous, rooting at distant intervals, sending up simple or once or twice forked branches 3 to 9 inches high. Leaves coriaceous, almost rigid, green inclining more or less to olive, slightly shining, with a midrib ending in a sharp, almost spinous, point. Stem leaves $\frac{1}{8}$ to $\frac{1}{5}$ inch long; branch leaves $\frac{1}{5}$ to $\frac{1}{4}$ inch long, more serrated, and much closer together than those of the stem. Spikes $\frac{1}{2}$ to $1\frac{1}{4}$ inch long, $\frac{1}{8}$ to $\frac{1}{5}$ inch in diameter, often with a few of the leaves on the apex of the branch on which it is placed adpressed and smaller than the lower ones, which gives the spike the appearance of being shortly stalked. Bracts of the spike variable in shape, from narrowly ovate to roundish reniform, subcordate at the base, sometimes gradually acuminated into a triangular point, at other times with a linear subsetaceous cusp.

The North American plant appears to be identical with the European.

Interrupted Club-moss.

SPECIES IV.—**LYCOPODIUM CLAVATUM.** *Linn.*

PLATE 1833.

Rabenh. **Crypt. Vasc. Europ. No. 66.**

Stem very long, creeping, much branched; branches at first ascending, afterwards prostrate, unbranched or irregularly dichotomous or pinnate. Leaves inserted all round the stem, approximate, most of them turned upwards and slightly falcate, so as to be subsecund; those on the under side of the stem adpressed to it, linear strap-shaped, acute, piliferous, finely and rather remotely spinous-dentate; leaves on the branches crowded, more closely placed than on the main stem, adpressed or ascending, incurved, similar to those on the stem, but less denticulate and the upper ones often quite entire. Peduncles from the termination of short branches, elongate, furnished with irregular whorls of small subulate leaves with membranous denticulate margins and terminal hairs, which are usually somewhat shorter than those of the stem-leaves. Spikes in pairs, more rarely solitary or three together, shortly pedicellate, linear-cylindrical or oblong-cylindrical, subobtuse. Bracts yellow, deltoid-ovate, gradually acuminated into a long cusp, which, at least in the lower bracts, often terminates in a hair, rounded at the base, finely denticulate on the margins.

On heaths and stony places. Rather frequent and generally distributed, though more common in mountainous districts.

England, Scotland, Ireland. Perennial. Summer.

Stem attaining the length of 1 or 2 yards, or even more; tough, wiry, rooting at distant intervals, much branched, but the branches seldom remain erect or ascending after they are 1 or 2 inches high. Leaves $\frac{1}{5}$ to $\frac{1}{4}$ inch long, exclusive of the white hair-like point, rather thin, bright green, with an evident midrib. Peduncles 1 to 4 inches long, rather slender; spikes $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long. Bracts at first adpressed and greenish, ultimately spreading or reflexed at the point, and straw-yellow. Sporangia reniform.

When L. clavatum is in fruit it cannot be mistaken for any other British species, this being the only one which has the spikes supported on a long slender peduncle. But sometimes when the hair-like point of the leaves is short, the barren stem bears some resemblance to that of L. annotinum; the leaves, however, of L. clavatum are thinner in texture, brighter green, less decurrent, and without the rigid almost prickly point which is found in L. annotinum; they are also less spreading, and almost always some of them at least have a white wool-like point, which indeed is sometimes as long as the leaf, and in the young plant generally forms a little tuft at the end of the growing branches. The North American L. clavatum is quite similar to the European.

Common Club-moss.

SPECIES V.—**LYCOPODIUM ALPINUM.** *Linn.*

PLATE 1834.

Rabenh. Crypt. Vasc. Europ. No. 96.

Stem rather long, creeping, prostrate, much branched. Branches ascending or erect, regularly two or three times dichotomous, so as to appear fasciculate; the ultimate branches of each fascicle of nearly equal length, approximate. Leaves inserted in four rows: those on the main stem remote and scale-like, strap-shaped, obtuse or subacute, entire; those on the branches approximate; the lateral ones opposite, placed edgeways to the stem, triangular subulate, falcate, broadest at the base, very acute, entire; those of the upper row imbricated, smaller than the lateral ones, narrowly elliptical-subulate, affixed by a narrow base, acute, entire; those of the lower row not imbricated, similar to those of the upper row, but smaller. Fertile branchlets repeatedly dichotomous, approximate, equal in length, usually conspicuously longer than the accompanying barren branchlets, with the leaves regularly imbricated in four rows round the stem, all similar, adpressed, lanceolate-subulate. Spikes solitary and sessile at the extremities of the ultimate divisions of the fertile branchlets, cylindrical; bracts ovate acuminated into a triangular cusp, subcordate, erose or denticulate.

On bare and stony places, common on mountains, but rare in low districts. With the exception of a station at Dunkerry beacon, south Somerset, it does not occur in the south of England, but from Cardigan, Brecon, Montgomery, Denbigh, Chester, Derby, and York, it is found northwards, as far as Orkney and Shetland. It occurs from north to south of Ireland.

England, Scotland, Ireland. Perennial. Summer.

Stem very tough, wiry, often partially buried, 9 inches to 2 feet long, round, whitish, with minute scale-like leaves. Branches $\frac{3}{4}$ to 5 inches high, produced at intervals; but each branch is so repeatedly divided that it looks like a little shrub. The barren branches, from the mode in which the leaves are inserted, appear flattened, convex above and concave beneath, with a ridge formed by the line of lower leaves. The leaves have some resemblance to those of the Savin, and are coriaceous, $\frac{1}{10}$ to $\frac{1}{8}$ inch long, rather pale dull green above, still paler and glaucous beneath. Ultimate branchlets $\frac{1}{2}$ to 2 inches long. Fertile branchlets 1 to 3 inches high, repeatedly dichotomous like the sterile ones, so that the spikes are produced in level-topped fascicles, containing commonly some multiple of four, such as 8 or 16 spikes. Spikes $\frac{1}{4}$ to $\frac{3}{4}$ inch long, a little thicker than the branches which support them. Scales at first olive and adpressed, afterwards yellowish-brown and spreading. Sporangia reniform, opening to the base.

Savin-leaved Club-moss.

EXCLUDED SPECIES.

LYCOPODIUM COMPLANATUM. *Linn.*

Reported from near Bramshot, Hants, and from Worcestershire, but requires confirmation. Under L. complanatum are included two plants—L. anceps, Wallroth, to which many authors confine the name of complanatum; the other L. Chamæcyparissus, A. Braun. Both these grow in Belgium and Scandinavia, and L. Chamæcyparissus in France. It is by no means unlikely to occur in Britain, especially as L. alpinum is not recorded from either of the supposed stations for L. complanatum. The barren branches of the two are so similar, that they can scarcely be distinguished; but in L. complanatum the spikes, 2 to 6 in number, are borne on a long peduncle, as in L. clavatum. Dr. Milde thinks it not improbable that L. alpinum may be merely a form of L. complanatum.

ORDER XCIII.—OPHIOGLOSSACEÆ.

Perennial herbs, frequently with a tuberous root producing 1 or more fronds with straight (not circinate) vernation. Frond commonly with 2 branches, the lower sterile, the upper fertile; very rarely the fertile frond is separate from the barren one, though some species produce accessory sterile fronds, or sterile fronds only on young and weak plants. Sporangia in simple or compound spikes, naked, coriaceous, without any thickened ring, 2-valved, opening by a transverse slit, rarely by a vertical slit. Spores all similar, very minute. Prothallium subterranean, destitute of chlorophyll, tuberiform.

The sporangia in Ophioglossaceæ are produced by a metamorphosis of the leaf itself, not from a single epidermal cell, as in Filices, from which these plants differ also in their straight vernation and subterranean prothallium destitute of chlorophyll.

GENUS I.—OPHIOGLOSSUM. *Linn.*

Herbs with a short fleshy tuberiform caudex, præmorse below. New frond produced exterior to the base of the stalk of that of the preceding year. Barren branch of the frond entire, more rarely forked or palmate; fertile branch stalked, undivided. Sporangia connate, disposed in a stalked 2-ranked simple linear flattened spike.

Name from ὄφις (*ophis*), serpent, and γλῶσσα (*glossa*), tongue.

SPECIES I.—OPHIOGLOSSUM VULGATUM. *Linn.*

Plate 1835.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 7.

Caudex oblong-cylindrical, very slightly swollen. Fronds usually solitary. Barren segment or frond ovate or oval or elliptical, rarely oblanceolate-elliptical, not greatly attenuated at the base, entire, rather thick, fleshy; veins conspicuous in the dried plant when held against the light, anastomosing and forming rather elongate areolæ at the base and centre of the frond, and short roundish-polygonal ones at the margin; primary areolæ containing secondary ones; cells of the epidermis flexuose-sided. Spike stalked, strapshaped-linear, compressed, apiculate; stalk cylindrical. Spores tubercled.

Var. α. *genuina.*

PLATE 1835.

Frond solitary, very rarely with a second frond or a barren frond from the same caudex. Barren segment or barren frond generally widest below the middle, more or less rounded at the base, or at least not greatly attenuated, even in fronds which have no fertile spike. Plant 4 to 15 inches high; spike $\frac{5}{8}$ to $1\frac{3}{4}$ inches long.

Var. β. *polyphyllum.* A. Br.

A Braun in *Seubert's* Flora Azorica, p. 17. *Milde*, Fil. Europ. p. 189.

O. vulgatum, var. microstichum, "*Acharius*," *T. Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 336.

O. vulgatum, var. ambiguum, *Coss. & Germ.* Fl. des Env. de Paris, ed. ii. p. 874. *Bab.* Man. Brit. Bot. ed. vii. 455.

O. vulgatum, polyphyllum, a. intermedium, *Vigineix*, and b. cuspidatum, *Milde*, Fil. Europ. pp. 188–189.

O. Azoricum, *Presl*, Suppl. Tent. Pterid. p. 309, teste *Milde*.

Fronds often with a second frond, or 1 or even 2 barren fronds from the same caudex. Barren segment or barren frond generally widest at or even above the middle, attenuated at the base, at least in those fronds which have no fertile spike. Plant 1 to 7 inches high; spike $\frac{1}{4}$ to $\frac{3}{4}$ inch long.

In meadows and pastures, rather common, and generally distributed throughout England, rather rare in Scotland extending north to Aberdeen, Elgin, Perth, and Argyle; possibly the Burn of Sandybank, Scalloway, Shetland, may be a locality for var. α, but more probably it produces var. β. Frequently throughout Ireland.

Var. β in elevated sandy ground, Scilly Islands, St. Agnes (Mr. F. Townsend), St. Martin's (Mr. I. Ralfs). Between Barmouth and Harlech, Merioneth (Mr. C. Bailey). In Orkney it is found at Barnorie (Swanbister), and Voeness Point, Smoogrow, both in Orphir, seen by myself; Black Craig, Stromness (Miss P. Duchar); Calf of Flotta (Mr. W. Irvine Fortescue), Calf of Cava (Dr. H. Halcro Johnston), Fara (Mr. J. Johnston), Hunda and Rysay Little (Miss Fortescue), all in Scalpa Flow.

England, Scotland, Ireland. Perennial. Summer. (Var. β in Orkney. Autumn.)

Caudex fusiform, yellowish, marked with transverse pits producing fleshy fibres about the thickness of a darning-needle, which are brittle, some of them forming buds on their upper surface close to the extremity from whence new fronds are developed. From the top of the caudex arises the frond, with its base enveloped in an olive-brown stipule-like sheath, the remains of the covering which envelopes the bud. At the time of fructification an elongated conical bud is found, which is the rudiment of the frond of the succeeding year. At the same time there may be seen the withered remains of the scale which enclosed the frond of the preceding year, and the scars whence still earlier fronds have rotted, and it is these scars which give a pitted appearance to the caudex. Fertile frond 4 to 15 inches high, the barren branch usually placed about the middle, but very variable in this respect; barren branch resembling a sessile decurrent leaf embracing the base of the stalk of the spike, 1½ to 4 inches long, varying from broadly ovate or oval to rather narrowly elliptical, acute or rather obtuse, entire at first, convolute when it appears above the ground in April, afterwards with the sides folded together, ultimately opening out until it is nearly flat. Fertile branch of the frond consisting of a stalked spike. The length of the stalk of the spike seems to have no relation to the luxuriance of the plant. In my herbarium are specimens with the stalk of the spike from a little over 1 inch to nearly 8 inches. Spike ¾ to 2 inches long, linear, flattened on both faces, but with a wider space between the series of sporangia on the side away from the barren branch; on each side of the groove, i.e. at the edges of the spike the sporangia are imbedded, they are contiguous and adherent to each other and at length open by a wide transverse slit; the apex of the spike is apiculate, and bare of sporangia. The spores are very minute and of the same sulphur colour as those of the genus Lycopodium; they are subglobular, and marked with distinct blunt tubercles. Occasionally there are two spikes produced and more have been observed, though not by myself.

In young or weakly plants the frond consists solely of a barren branch, quite similar to that of the barren branch of the complete frond; like it, it is thick, fleshy, bright green; it is so thick that when held up against the light when living the venation is scarcely perceptible, but when the plant is dried it may be very clearly seen; there is no midrib, but the veins anastomose, forming meshes which are long and narrow towards the base and along the centre of the frond, but become smaller and shorter in proportion as they approach the margin; the primary meshes are again divided into smaller meshes by finer anastomosing veins: some of these secondary veins are often free.

Of var. β there are two forms; that found by Mr. Townsend in the Scilly Isles and the Orkney plants from the Calf of Flotta and the Calf of Cava belong to the form termed intermedium by Vigineix and, according to Milde, the O. vulgatum var. ambiguum of Cosson and Germain. My specimens are from 1 to 2½ inches high; the barren branch of the frond is broadly oval and situated usually above the middle of the step so that the spike has a stalk sometimes as short as ½ inch, or even less. The Orphir plant appears to be the form termed cuspidatum by Milde; some of my specimens of it are quite similar to the specimens of O. polyphyllum, which I have from Madeira and the Azores; it is generally 2 to 4 inches high, but in the year 1855 I found specimens 7 inches high, though in no other year have I found them above 5 inches and generally less. The barren branch is usually placed below the middle of the stem and mostly very conspicuously so, so that the stalk of the fertile branch is 3 or 4 times longer than the portion between the caudex and the barren segment. Two fronds from one caudex are common, and frequently these accessory fronds are without a spike. In both forms the spike is from ¼ to ¾ inch long. Except in this particular and in size it does not differ from the ordinary form of O. vulgatum. In Orkney it grows only on fine short grass, often within the earthen enclosures where sheep are driven, termed "buchts." Cultivated in pots in a cool greenhouse it maintains its small size, and fruits freely, but it appears to be much less hardy than the common Ophioglossum, and I cannot get it to thrive in the open ground; it seldom survives more than the one season after it is planted out, and I have never got it to produce a fertile spike in the garden, though the common form of O. vulgatum grows wild about Balmuto.

The plant is quite easy to cultivate and certainly does not require to grow amongst herbage; it increases rapidly by means of the root-fibres which run along almost horizontally beneath the surface of the ground. Some of these become swollen at the extremity, and beneath this swelling a root is formed—apparently a continuation of the fibre on which the swelling exists; the swelling developes into a bud which in the succeeding year produces a barren frond; the year after, this is succeeded by another barren frond, and it is not till the third or fourth year that a frond with both barren and fertile branches is developed. As the runner-like roots persist for more than one year, we frequently find two or more plants in different stages of development connected by them with the parent. A detailed account of the growth of Ophioglossum vulgatum, by Mons. Duval Jouve, will be found in C. Billot, 'Annotations à la Flore de France et d'Allemagne,' pp. 247–250.

Common Adder's-tongue.

SPECIES II.—OPHIOGLOSSUM LUSITANICUM. *Linn.*

PLATE 1836.

Rabenh. **Crypt. Vasc. Europ. Exsicc. Nos. 28 and 111.**

Caudex oblong-fusiform, slightly swollen. Primary frond often accompanied by 1 or more barren ones. Barren segment or frond greatly attenuated at the base, strapshaped-elliptical or strapshaped-oblanceolate, entire, very thick and fleshy; veins scarcely observable (even in the dried plant) when held against the light, anastomosing and forming a few elongate areolæ; primary areolæ usually without secondary ones; cells of the epidermis straight-sided. Spike stalked, oblong or linear-oblong, compressed, rostrate; stalk slightly thickened upwards. Spores without tubercles.

In pastures, very local, discovered by Mr. George Wolsey in the island of Guernsey; "it occurs amid short and very level herbage sloping towards the south, on the summit of rocks on the south coast of the island and not far from Petit Bot Bay. On this elevated down are a few scattered and stunted furze bushes, and around these the grass is as usual somewhat longer, and here the little Adder's-tongue is not quite so minute as on the level turf where it scarcely attains an inch in height. It grows in company with Trichonema Columnæ and Scilla autumnalis, and on the 17th of January was in full fruit." ('Phytologist,' 1854, p. 80.)

In the fifth edition of the 'History of British Ferns,' p. 195, the late Mr. E. Newman states that it is found also near the Land's End in Cornwall, but I have been unable to get any information about the Cornish locality. Mr. H. Chichester Hart reports it from "the north side of Horn Head, Donegal," where he found a "few plants in August, 1878." ('Journ. of Bot.' 1879, p. 149.) From the date of fruiting and the unlikeliness of O. Lusitanicum occurring so far north, I fear it is likely to prove O. vulgatum, var. β. polyphyllum.

England? Ireland? Channel Islands! Perennial. Winter.

The Guernsey plant is 1 to 2 inches high. The sterile branch of the frond is generally placed about the middle of the stem, and is $\frac{1}{2}$ to 1 inch long, very much attenuated at the base, acute; the stalk of the spike varies from $\frac{1}{4}$ to 1 inch. The spike itself is from $\frac{1}{10}$ to $\frac{3}{10}$ inch long.

Besides the small size and the winter fructification, O. Lusitanicum offers several points of contrast with O. vulgatum, although it does present some resemblance to the smaller states of the var. polyphyllum of the latter, with which it agrees in having often more fronds than one produced simultaneously from one caudex. In O. Lusitanicum the caudex is considerably more swollen and tuber-like than in O. vulgatum. The barren fronds and barren segments of the complete frond are always narrower and much more attenuated at the base, much thicker in texture, so that it is difficult to make out the venation; but this may be done by steeping the dried plant in water, and holding it against the light. The network of veins is then seen to have the meshes much more uniformly elongated, and the primary meshes do not (or but rarely) contain secondary veins. The cells of the epidermis are separated by straight boundary lines, while in O. vulgatum the boundaries of the cells are sinuous. The spike contains fewer sporangia in each row; in the Guernsey plant they are three to six on each side; but I have Continental specimens with as many as ten in the row, and Milde says there are sometimes nineteen. The sporangia do not extend so near the apex of the spike as in O. vulgatum, the bare part extending like a little point or spur beyond the fertile part and bearing a much greater proportion to the length of the spike than in O. vulgatum. The spores are considerably smaller than in O. vulgatum, and are quite smooth.

Dwarf Adder's-tongue.

GENUS II.—**BOTRYCHIUM.** *Schwartz.*

Herbs with the caudex not tuber-like, passing downwards into a slender creeping branched root. Frond produced within the base of the stalk of that of the preceding year. Barren branch of the frond varying from oblong and pinnate or even only pinnatifid to deltoid and ternately decompound; fertile branch stalked or subsessile, once to 3 or 4 times compound, oblong-triangular or deltoid, nearly all in one plane or incurved. Sporangia free, disposed in a distichous compound or decompound spike.

Name from βότρυς (*botrus*), a bunch of grapes, from the appearance of the fertile branch of the frond.

SPECIES I.—**BOTRYCHIUM LUNARIA.** *Schwartz.*

PLATE 1837.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 9.
B. lunatum, *Gray*, Nat. Arr. Brit. Plants, Vol. II. p. 19.
Osmunda Lunaria, *Linn.* Spec. Plant. p. 1519. *Sm.* Eng. Bot. ed. i. No. 318.

Base of the frond without a slit on one side where it encloses the bud that forms the frond of the succeeding year. Sterile segment of the frond placed about the middle or above the middle of the whole frond, sessile, oblong or ovate-oblong, pinnate; terminal segment truncate and incised at the apex; pinnæ lunate or fan-shaped, entire or crenate, or more rarely incised at the apex, without a midrib; veins radiating from the base, repeatedly forked, not extending quite to the margin; cells of the epidermis straight-sided. Fertile branch of the frond conspicuously stalked; stalk often exceeding the length of the barren portion; lamina a compound spike, triangular or deltoid, with the primary branches spreading.

Var. α. *genuinum.*

Margins of the pinnæ entire or crenate.

Var. β. *incisum.* Milde.

B. Lunaria, var. Moorei, *Lowe*, Native Ferns, Vol. II. Tab. 76 *b*.
B. Lunaria, var. rutaceum, *Fries*, Summ. Veg. Scand. pp. 83, 252.

Margins of the pinnæ rather deeply and irregularly incised.

In pastures and on heaths where the herbage is short. Not very common but generally distributed, occurring from the extreme south of England north to Orkney and Shetland. Sparsely distributed throughout Ireland, and reported in the 'Cybele Hibernica' to be plentiful in some of the limestone pastures of Galway and Clare. Var. β, Halifax, Yorkshire; Crosby Ravensworth, Westmoreland; Horsley, Tyneside, Northumberland! Pentland Hills, Edinburgh! Kilnasaton, Dublin.

England, Scotland, Ireland. Perennial. Summer.

Caudex or rootstock obliquely descending, thickened upwards, creeping, sending forth fleshy root-fibres which are simple or once or twice branched. Plant 2 to 10 inches high; stipes stout, clothed at the base with a brown lacerated membrane formed from the decayed frond of the preceding year, and enclosing within its hollow base the rudiment of the succeeding year's frond. Sterile branch ½ to 3 inches long, with from 3 to 8 pairs of fleshy bright-green pinnæ. These pinnæ are from ⅛ to ½ inch long and usually broader, the larger ones nearly semicircular and attached by a wedge-shaped base, each side of which is curved, so as to leave a blunt cusp directed backwards on either side where it meets the curve of the semicircle; the upper pinnæ attain little more than a quarter of a circle, and have the wedge-shaped base more excavated on the posterior than on the anterior side of the base. The pinnæ are all connected by a herbaceous strip down each side of the midrib of the barren branch of the frond; when young these pinnæ or segments are folded inwards over the fertile branch of the spike, the lower cusp of each pinna overlapping the upper cusp of the pinna situated below it; the terminal lobe is commonly trifid. The stalk of the fertile branch between the barren branch and the base of the spike is from ½ to 2½ inches long; the spike itself is from ½ to 2½ inches, the primary branches spread horizontally to the right and left; these branches, or at least the lower ones, are generally compound and triangular, becoming shorter as they approach the apex of the spike; but more rarely they are twice compound, and in small specimens they are all simple. The sporangia are arranged along the edges of the ultimate divisions of the spike, on their inner side, that is, looking towards the barren frond; they are about the size of poppy-seed or a little larger, at first green, afterwards orange. The spores are pale yellowish-white, roundish-trigonous, smooth, areolated.

The var. β scarcely deserves mention. It differs merely in the crenatures which are often present in the more common form, being separated by more or less deep incisions of unequal depth, so as to give a fimbriated appearance to the margins of the pinnæ.

Monstrosities occur in which the barren branch is tripartite, each division resembling the ordinary barren branch of the frond. This is the var. *tripartitum* of Moore ('Nat. Print. Brit. Ferns,' 8vo. ed. vol. ii. pp. 324 and 332), which was found at Kilmashogue Hill, co. Dublin, by the late Dr. Kinahan, and called by him var. cristatum. I have a monstrous specimen from Southerness, Kirkcudbright, collected by the late Sir William Jardine, in which the fertile branch is tripartite, producing 3 spikes. I have another from Northumberland, in which, from the side of the barren segment, a branch is produced, the lower part of which is barren and the upper fertile. I have 2, one from Northumberland and the other from Kirkcudbright, in which, from the base of the lowest pinna of the fertile segment, a stalked compound spike is produced; and lastly, I have one from Northumberland in which sporangia are placed round the edges of the pinnæ of the barren segment.

Botrychium Lunaria evidently increases by subterranean buds; but the origin of these buds has not, so far as I know, been ascertained. In all probability they are developed at the extreme apex of runner-like shoots, or in the axils of their forks. The bud so produced remains in a rudimentary state underneath the ground, instead of springing up at once into a barren frond, and it is not until the fourth year that it rises above ground, at which time both fertile and barren branches are fully developed. The plant is said to appear in April; but in cultivation I have never found it do so earlier than the beginning of May, and it dies off in August. If the base of the stipes of the plant be cut longitudinally, it will be found to contain the young frond of the ensuing year, and within this the frond for the next again. This has been worked out by the late Mr. Newman, whose observations were made in May 1843, and he found that each frond was placed alternately, "*i.e.*, having laid all the specimens before me with the fruit on the right-hand and the leafy portion on the left, then the frond for 1844 invariably had the fruit on the left and the leafy portion on the right; the frond for 1845 appearing to be again reversed, having the fruit on the right and the leafy portion on the left." (Newman, 'Brit. Ferns,' ed. iii. p. 316.)

There is not the slightest reason for thinking that the Moonwort or the Adder's-tongue is parasitic, yet fern-growers seem to think it cannot be cultivated for any length of time unless grown in a tuft of grass. Mr. Newman goes the length of saying that it should be dug up with a large sod and placed in a pot, and the grass kept short with a pair of scissors, and watered in dry weather "for the purpose of keeping the grass green and vigorous;" and Mr. Moore states that Mr. Wollaston, one of the most successful cultivators of Ferns, has told him "that he finds that to keep the plant over the second year, it is absolutely necessary to grow it in a tuft of grass." I have grown plants of it for 4 years in an unheated greenhouse without any herbage about it, and it thrives well. The plants were taken up in June, the whole of the surrounding grass removed, but the soil left about the roots. They were potted in light loam from mole-hills in the field where they grew, interspersed with fragments of limestone for drainage, and received no attention except removing any extraneous plant that appeared in the pot. Previously, I had tried growing it with grass, and found the grass flourished and the Botrychium died. I suspect each frond is short-lived, as in the wild state it is often not seen for years in a spot where it has been found.

Moon-wort.

EXCLUDED SPECIES.

BOTRYCHIUM RUTACEUM. *Schwartz.*

B. matricariifolium, ***A. Braun.*** ***Milde,*** **Fil. Europ. p. 195.**
B. Lunaria, var. δ, ***Sm.*** **Eng. Fl. Vol. IV. p. 328.**

The supposed authority for this is a passage in Ray's 'Synopsis,' where he mentions a plant, "Lunariam minorem ramosam et Lunariam min. fol. dissectis. Westmoreland. D. Lawson hujus plantæ varietates esse; non distinctas species opinatur. D. Doody ('Syn.' 11. App. 340) Lunariam minorem foliis dissectis revera distinctam speciem vult, cum segmenta seu lunulæ non solum eminenter sint sectæ, sed planta etiam elatior sit et botrus racemosior. Est Lunaria botrytis minor pinnulis laciniatis in Borealibus nostris (Pluk. Ann. 288). Mr. Doody received it from Sir Thomas Willughby, but "hath since seen it several times gathered by our herbwomen." (Raii 'Syn.' 129.)

From this passage Mr. Newman draws the following conclusions:—

"1. That Ray supposed there were two British species of Botrychium distinct from Lunaria.

"2. That Mr. Lawson thought them both varieties of Lunaria.

"3. That Dillenius believed one of them, described as with 'foliis dissectis,' to be a distinct species.

"4. That this species, or supposed species, was 'found by or known to Ray, Lawson, Doody, Willughby, and the herbwomen.'" (Newman, 'Phyt.' 1854, p. 30.)

No one can doubt that Mr. Newman is right in his deductions, but I do not see how they prove Ray's plant to be B. rutaceum. There is no mention of the midrib to the pinnæ, nor of their being pinnatifid: and the mere mention of lunules in connection with the pinnæ would seem to exclude the idea of B. rutaceum, in which the pinnæ have no lunate appearance whatever. Again, B. rutaceum is ordinarily a smaller plant than B. Lunaria. I am inclined to add a fifth deduction to those of Mr. Newman, viz.:

5th. That this species or supposed species is B. Lunaria, β. incisum, *Milde*, which I have mentioned in its proper place.

There still remains a passage in Smith's 'English Flora.' After describing the ordinary form of B. Lunaria, he adds the following paragraph:—

"β has a branched stalk, bearing several leaves and compound spikes alternately disposed. γ is a very slight variety, with more jagged leaflets than ordinary. δ has pinnatifid leaflets and a more spreading habit. All these varieties, and perhaps others, are found occasionally intermixed here and there with the plant in its proper or common form; but never, as far as I could learn, so numerously distinct as to have the appearance of a different species." (Sm. 'Engl. Fl.' vol. iv. p. 329.)

In this paragraph β is the monstrous form termed tripartitum by Mr. Moore; γ is the plant I have before mentioned as B. Lunaria, β. incisum; and δ is probably the true B. rutaceum. Smith appears, if not to have seen, at least to have heard of, the occasional occurrence of all these forms; and as B. rutaceum is a plant likely to occur in Britain, and liable to be overlooked, it is just possible that it may really be a native.

BOTRYCHIUM LANCEOLATUM. *Ångström.*

B. rutaceum, *Newm.* in part, Hist. Brit. Ferns, ed. iii. pp. 320–324.

Mr. Newman writes of a Botrychium, which he supposes to be B. rutaceum, "Mr. Cruickshank says in a note: 'I found it on the Sands of Barry, near Dundee, in August, 1839. I observed but three specimens, all of them exactly alike excepting a small difference in size, and I could find none of the common form of the plant growing near them.' Mr. Cruickshank sent me a drawing, which I did not at the time recognise as representing the present species (B. rutaceum). A carefully accurate engraving of this will be found at p. 324, Newman's Brit. Ferns, ed. iii. p. 321."

Of this drawing Mr. Moore says, "Dr. Milde's own illustrations of B. lanceolatum, including Fl. Dan. T. 18, fig. dext. are most nearly accordant with the figure of the Dundee plant, which should probably bear the name of var. lanceolatum instead of rutaceum, hitherto applied to it." (Moore, 'Nat. Print. Brit. Ferns,' 8vo. ed. vol. ii. p. 332.)

Under B. lanceolatum Dr. Milde says, "Newm. Hist. of Brit. Ferns, 1854, figura pag. 324, ad B. lanceolatum pertinere videtur" (Milde, 'Fil. Europ.' p. 197).

I do not think there can be any doubt that Mr. Newman's figure here referred to represents B. lanceolatum, and not B. rutaceum; neither have I any doubt that Dr. Milde is right in considering that B. Lunaria, B. rutaceum, and B. lanceolatum are three distinct species. Unfortunately no further information can be obtained about the plant from the Sands of Barry, nor can any of Mr. Cruickshank's three specimens be traced to their present owners, so far as I can discover. No one else has found it there, still B. lanceolatum seems to have a better claim to be included in the British lists than B. rutaceum."

ORDER XCIV.—**FILICES.**

Herbs, rarely trees, very rarely annuals, sometimes with creeping buried or exposed rootstocks, in which case the leaves or fronds are few and distant, in other cases with a stem (*caudex*) or in Tree-ferns a trunk, producing a circle of fronds like the feathers of a shuttlecock. Fronds very various in shape and division, usually supported on a stalk (*stipes*) which is continued as a midrib through the expanded part of the frond, and there is termed the *rachis*. Sporangia borne on the back or margin of the fronds, usually attached to the veins, each formed from a single epidermal cell, opening transversely or longitudinally, with a more or less complete vertical or transverse or apical ring of thickened tissue (*annulus*). The sporangia are collected into groups termed *sori*, which are round, oblong, linear, or curved, and sometimes naked, sometimes covered when young by a membrane (*indusium*), sometimes enclosed in pouches (*involucres*). Prothallium flat, green, resembling a frondose Liverwort, producing on its under side archegonia and antheridia, the former producing a new plant when fertilised by the antherozoids of the antheridia.

According to Dr. W. G. Farlow, in Pteris serrulata, the prothallium was found in about 50 cases to produce a young plant, where no traces of archegonia were seen. See 'Journ. Bot.' 1874, p. 185. If this viviparous production of young plants be general, it may account for the numerous curious facts that occur in the rearing of Ferns from spores.

SUBORDER I.—**OSMUNDACEÆ.**

Sporangia with an incomplete annulus on one side immediately beneath the apex, opening by a longitudinal slit on the side opposite to the incomplete annulus, and extending across the apex.

GENUS I.—**OSMUNDA.** *Linn.*

Caudex massive. Fronds tufted, coriaceous or herbaceous, pinnate or bipinnate. Sporangia on a separate frond or on a portion of a frond so contracted that it appears to be made up of clusters of sporangia arranged in a compound spike, rarely with the barren portion interrupted by a few fertile lateral pinnæ.

Name Osmunda, a Saxon name of the god Thor. But some authors derive it from Osmund, a Saxon waterman, who is said to have hidden his wife and children among the Royal Fern on an island in Loch Lomond, during an incursion of the Danes.

SPECIES I.—**OSMUNDA REGALIS.** *Linn.*

PLATE 1838.

Rabenh. Crypt. Vasc. Exsicc. No. 10.

Stipes nearly as long as the laminæ of the frond, rarely only half as long. Barren frond subcoriaceous, pale green, glabrous when mature, clothed with cinnamon-coloured arachnoid hairs when young, which come off in floccose patches as the frond developes, oblong or ovate-oblong, with a triangular apex, bipinnate; ultimate pinnules strap-shaped or oblong strap-shaped, obliquely truncate or sometimes half-cordate at the base, tapering towards the subobtuse or subacute apex, very minutely serrulate or crenate, or almost entire; veins running from the midrib of the pinnules to their margins, twice or thrice forked. Fertile fronds similar to the barren ones, but with 3 to 9 of the upper pairs of pinnæ and the apex of the frond bearing contracted spur-shaped pinnules, thickly clothed with roundish and often coalescent glomerules of sporangia.

In bogs, meadows, wet heaths, and damp woods, and on wet ledges of rock. Sparingly distributed over England and Scotland, but much more abundant towards the west side of the island, extending from Cornwall, Devon, Dorset, Hants, Sussex, and Kent, to Sutherland and Caithness. It does not appear to be recorded from Orkney; but I think the late Mr. Robert Heddle told me he had found it there. Generally distributed throughout Ireland, but there also more plentiful in the west.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant with few heads, the caudex attaining a large size before it divides; divisions of the caudex nearly vertical, thickly clothed with the decayed bases of former fronds, in old luxuriant plants sometimes attaining a height of 2 feet above the ground, but in exposed situations only rising a few inches. Fronds 5 to 12, erect or when very luxuriant arching backwards, usually 2 to 4 feet high, but in favourable localities often much taller. I have seen it 5 or 6 feet high in the Isle of Bute; Mr. Newman has measured fronds 8 feet high on the banks of Loch Fyne; Mr. W. Bennett records it about the same height in Merivale Wood, at the foot of Leith Hill, Surrey; and Mr. T. Moore says it is occasionally 10 to 12 feet high in very damp, sheltered spots. The rachis is attached by a narrow base to the caudex, and gives off a strong root-fibre from its back above the point of attachment, above which it is greatly enlarged and furnished on each side with a stipule-like expansion, something like the blade of a feather, or still more like the pen found in the cuttle-fish called the squid (Loligo): in large plants this wing is from 2 to 4 inches long, projecting $\frac{1}{4}$ to $\frac{1}{2}$ an inch, it ends rather abruptly upwards; it is plicate and crisped at the margin, and splits readily from above obliquely downwards. The rachis itself is green, convex on the back, flattened on the anterior surface, which is bounded by two slightly raised rounded strips; when cut through the vascular bundle is visible as a curved line with its two free ends rolled inwards. The fronds are at first tinged with reddish but become pea-green when mature, they have 5 to 9 pairs of rather distant and nearly opposite pinnæ; the pinnules or ultimate segments are subsessile, 5 to 14 pairs in each pinna, each one $\frac{3}{4}$ to $2\frac{3}{4}$ inches long by $\frac{1}{4}$ to $\frac{5}{8}$ inch broad; they are placed nearly opposite to each other, and are more developed on the lower side than on the upper; their texture is very firm, and their surface throws off rain or dew without being wetted. The veins are either given off from the midrib in pairs or divide immediately after leaving it, and are again often once or twice forked, the ultimate segments running into the notches between the extremely minute serrulations, and not into their apices. The fronds begin to develope in May, and perish with the first sharp frost. The fertile fronds have from 2 to 6 of the lower pair of pinnæ quite like those of the barren fronds, but the upper ones have the pinnæ cut down to a winged midrib, from each side of which herbaceous processes are given off, round which the sporangia are clustered. These metamorphosed pinnæ are from ¼ to 1½ inch long; they are at first green, afterwards olive-yellow, and ultimately they become of a rusty-brown colour. The spores are green while they are capable of germinating, but become pale yellow when they have lost their vitality.

This plant has no varieties, properly so called, found in Britain; *cristata* and *interrupta*, Moore, being malformed states or monstrosities. It sometimes occurs with the rachis divided or with the leaflets lobed and crisped. Not unfrequently on the fertile fronds some of the barren pinnæ are fertile on one side, and in this case the opposite side is divided into rounded lobes; this lobing evidently being the first stage of the transition from the barren to the fertile pinnules.

Royal Fern, Flowering Fern, or Osmund Royal.

SUBORDER II.—**HYMENOPHYLLACEÆ.**

Sporangia placed on an extended vein, which forms a receptacle enclosed in an involucre. Each sporangium with a complete obliquely-transverse annulus, opening by a longitudinal slit.

GENUS II.—**TRICHOMANES.** *Linn.*

Rootstock usually creeping. Fronds more or less translucent, often consisting of but a single layer of cells. Sori marginal, arranged round the lower part of a filiform elongated receptacle terminating a vein. Involucre tubular, undivided, truncate or slightly 2-lipped, often falling short of the receptacle.

Name from θρίξ (*thrix*), hair, and μανός (*manos*), loose.

SPECIES I.—TRICHOMANES RADICANS. *Swartz.*

PLATE 1839.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 116.
T. speciosum, *Willd.* Sp. Pl. Vol. V. p. 514. *Milde,* Fil. Europ. p. 10. *Newm.* Hist. Brit. Ferns, ed. ii. p. 305.
T. brevisetum, *R. Br.* Hort. Kew. ed. ii. p. 529. *Sm.* Eng. Fl. Vol. IV. p. 324.
T. alatum, *Hook.* Fl. Lond. Tab. 53 (non *Swartz*).
T. pyxidiferum, *Linn.* (parte) Sp. Pl. 1561 (non Auct.). *Huds.* Fl. Eng. p. 461.
Hymenophyllum alatum, *Sm.* Eng. Bot. No. 1417.
H. Tunbridgense, var. *β*, *Sm.* Fl. Brit. Vol. III. p. 1417.

Rootstock wiry, elongate, creeping, thickly covered with long pitchy brown hairs intermixed with shorter ones. Fronds distant. Stipes wiry, from one-fourth as long to as long as the lamina of the frond, with hair like scales similar to those on the rootstock at the base, nearly naked above, with an herbaceous wing on each side, which is broadest at the top and vanishing towards the base. Lamina about twice as long as broad, translucent, consisting of but a single layer of cells, ovate or lanceolate, twice or thrice or four times pinnatipartite, dark green; ultimate segments wedge-shaped at the base, pinnatifidly lobed; rachis and secondary rachides winged; veins branching, with a branch running into each ultimate segment, but not extending quite to its apex. Involucre solitary, more or less exserted, cylindrical-obconic, more or less winged, truncate or very indistinctly 2-lipped; receptacle more or less ultimately exserted.

Var. *α. genuinum.*

Frond ovate or oblong-ovate. Involucre conspicuously exserted.

Var. *β. Andrewsii.*

Frond lanceolate. Involucre nearly wholly immersed in the substance of the frond. Receptacle projecting much more beyond the involucre than in var. *α*.

On wet, shady rocks and banks, very local. Formerly found at Bell bank, near Bingley, in the west of Yorkshire. In North and South Wales (Mr. Backhouse, who considers the South Wales station at least as a natural one). Near Corrie, Arran, but probably planted there. In several places in the south and south-west of Ireland. "Valentia (perhaps introduced, Kinahan); Waterville; Turk Mountain and near Killarney; Kenmare; Glouin (or Glen) Caragh; near Derriana Lake and Lough Carragh; Dingle; Mounteagle; near

Bantry; Bandon; Templemichael Glen (Mr. D. Murray and I. Carroll). On the Glashgariff river, Cork (Drummond). Near Blarney (I. C.). Near the summit of Carrigana Kildorrey, north of Cork (I. C.); Glenbower Wood, near Cork; Glendine Wood, Waterford (Kinahan). Sparingly at Powerscourt waterfall; and a few plants in Hermitage Glen, Wicklow, Flor. Hib. (not found lately). Cumaelta Mountains (Moore, Nat. Pr. Br. F.); Glenstal, Barrington's Bridge, near the Keeper Mountain, Limerick (Mr. G. A. Pollock); on the banks of the Clare river, three miles south of Newport, Tipperary (Mr. G. H. Kinahan). (This station may extend to district 7.)"—'Cybele Hibernica,' p. 378.

Var. β. In a moist, rocky cave, Blackstones, Glouin Caragh, Kerry (Mr. W. Andrews), and near Killarney, Mr. Isaac Carroll.

England, [Scotland,] Ireland. Perennial. Summer, Autumn.

Rootstock about the thickness of a crow-quill, emitting wiry, forking, radical fibres, densely tomentose with scales resembling hairs. Stipes varying from 1 to 6 inches; lamina 3 to 12 inches; pinnæ and divisions of pinnæ all connected by a broad wing, so that the frond must be termed pinnatipartite instead of pinnate; ultimate lobes oblong, with short, entire or bifid teeth. Involucre situated on the lowest anterior branch of the vein of the ultimate segments, urn-shaped, tapering below, about $\frac{1}{10}$ inch long, pale green. Receptacle bristle-shaped, sometimes scarcely exceeding the involucre, but usually ultimately twice as long or more. Spore-cases reddish, concealed within the involucre.

Of var. β. I have no specimens, but judging from the figure in Mr. Newman's 'British Ferns,' it appears to differ from the ordinary form only in the frond being narrower and more acuminated, the receptacles immersed in the substance of the leaves, and the bristle or receptacle sometimes 3 or 4 times longer than the involucre; Mr. Andrews, in his description, says 6 times longer. Mr. Andrews lays some stress as a distinctive feature on "the lower pinnæ being distant and short;" but this occurs in var. α, of which I have specimens in which the same rootstock bore some fronds having the lowest pinnæ longer than the succeeding, and others in which they are considerably shorter.

This fern is remarkable for the slow development of its fronds, and their lengthened duration, as they are not fully developed until the second year, and until then the involucres are not produced. According to Milde, however, the Mexican form is said to be fructiferous in the first year. Mr. Andrews, as quoted in Newman's 'British Ferns,' says no disposition to bear fruit is shown until the autumn of the third year, when the involucres appear, and the setæ and capsules attain maturity in October. After this the fertile frond begins to decay, but sterile fronds have even a longer existence.

The Bristle-fern is easily cultivated, and its semitransparent foliage presents an exceedingly attractive appearance. The easiest method of culture is to plant it in a pan (unglazed if possible), filled with broken sandstone and peat. Place the pan in a larger glazed pan, in which keep water. Cover with a glass fitting into the outer pan, and leaving a space between the glass and the margin of the inner pan, or place the two pans in a hand-light or window fern-case. The outer pan should never be without water, the object being to keep up a damp atmosphere round the Fern by the evaporation of the water in the outer pan, and allow no stagnant water about the roots.

Bristle-fern.

GENUS III.—**HYMENOPHYLLUM.** *Smith.*

Rootstock filiform, creeping. Fronds translucent, usually consisting of but a single layer of cells. Sori marginal, arranged round a slender columnar receptacle, terminating in a vein. Involucre 2-valved or deeply bipartite, usually equalling or exceeding the receptacle.

Name from ὑμήν (*humen*) a membrane, and φύλλον (*phullon*) a leaf, alluding to the delicate membranous texture of the frond.

SPECIES I.—**HYMENOPHYLLUM TUNBRIDGENSE.** *Smith.*

PLATE 1840.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 80.
Trichomanes Tunbrigense, *Linn.* Sp. Plant. 1561.

Rootstock capillary. Fronds flat and glabrous, translucent, consisting of a single layer of cells scarcely longer than broad, ovate-oblong or lanceolate-oblong, pinnatipartite, with the pinnæ all connected by a wing running down each side of the rachis and extending a short distance down the stipes; pinnæ flat, pinnatipartite or pinnatifid, with the segments alternate, and on both the upper and lower sides of the main vein, at least those at the base of the frond (the pinnæ near the apex being divided on the anterior side only); ultimate divisions strapshaped, spinous-serrulate. Involucres at the termination of the first or first and second anterior veins given off by the main vein of the pinnæ, broadly oval; valves semicircular, flattish, serrate-denticulate or spinous-denticulate at the apex. "Receptacle furnished with paraphyses at the base" (Milde).

On rocks, more rarely on steep banks, or even trunks of trees.

Rather local, but widely distributed. Chiefly in the west of England and Scotland, Cornwall, Devon, Somerset, Sussex, West Kent, Glamorgan, Merioneth, Carnarvon, Yorkshire, the Lake district, Northumberland, Dumfries, Peebles, Stirling, Dumbarton, Renfrew, Argyle, Bute, Arran and Mull. In Ireland it is local, being rare in the east, centre and north of the island; it occurs in Kerry, Cork, Waterford, Tipperary, Kilkenny, Limerick, Clare, Longford, Galway, Sligo, Leitrim, Donegal, Tyrone and Down.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant growing in sheets or mats, with the black hair-like rootstocks interlaced; these are much branched, and emit numerous hairy rootlets, which attach themselves to the rock or substance on which the plant grows; they are nearly naked, having a few brown hair-like scales on their younger portions, and commonly a small tuft at the base of the young fronds Stipes setaceous, a little thickened upwards, $\frac{1}{2}$ to 2 inches long; lamina $\frac{3}{4}$ to $4\frac{1}{2}$ inches long, by $\frac{1}{2}$ to 1 inch broad; lower pinnæ somewhat flabellately pinnatifid or pinnatipartite, which arises from the distribution of the veins; the main vein of each pinna gives off a lateral vein first on the anterior side, then on the posterior, then another anterior branch, and often a posterior following it; each of these branches is commonly forked, or sometimes twice forked, and so is the termination of the main vein; the ultimate veins do not quite reach the apex of the ultimate divisions; in the uppermost segments the veins frequently branch only on the upper side. Involucres about $\frac{1}{10}$ inch long, inversely deltoid at the base, which is somewhat swollen; the valves are flattened horizontally, and project beyond the substance of the leaf. The sporangia are wholly included, and the vein or receptacle on which they are placed does not extend beyond them.

The leaves in texture, and in the shape of their ultimate divisions, bear considerable resemblance to those of the barren stems of the moss, Mnium undulatum, *Hedwig.*

Tunbridge Filmy Fern.

SPECIES II.—**HYMENOPHYLLUM UNILATERALE.** *Bory.*

PLATE 1841.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 120.

H. Wilsoni, *Hook.* *Wilson*, Eng. Bot. Supp. No. 2686. *Bab.* Man. Brit. Bot. ed. vii. p. 454. *Fries*, Summ. Veg. Scand. pp. 83, 253.

H. peltatum, *Desvaux*, Ann. Linn. 1827, p. 333. *Rabenh.* l.c.

H. Tunbridgense, var. *Bentham*, Handb. Brit. Fl. p. 638. *Baker* in *Hook.* & *Bak.* Syn. Filic. ed. ii. p. 67.

Trichomanes peltatum, *Poiret*, Enc. Bot. Vol. VIII. p. 76, fide *Desvaux.*

Rootstock capillary. Fronds convex, recurved, glabrous, translucent, consisting of a single layer of cells nearly twice as long as broad, lanceolate-oblong or narrowly oblong, pinnatipartite, with the pinnæ all connected by a wing running down each side of the rachis, and extending a short distance down the stipes; pinnæ recurved, pinnatipartite, with the segments all on the anterior side of the main vein, even in those at the base of the frond, simple or once forked; ultimate divisions strapshaped spinous-serrulate. Involucres at the termination of the first anterior vein given off by the main vein of the pinnæ, ovate; valves ovate, convex, entire throughout. Receptacle without paraphyses.

On rocks and trunks of trees, often growing with H. Tunbridgense, but much more frequent, especially in the north-west of England and Scotland, extending north to Orkney (where it was found by the late Mr. Heddle near the Kame of Hoy, and in 1880 by Mr. H. H. Johnston on the Wart Hill of Hoy), and Shetland. Frequent in mountainous districts in Ireland, especially in the west and north.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Very similar to H. Tunbridgense in general appearance, and about the same size. It is easily recognised when growing by its dark lurid green fronds, recurved at the apex and margins, while in H. Tunbridgense they are flat and paler green. But even in the dried state it may be known by the narrower pinnæ, of which the main vein branches only on the upper side, consequently they have the segments all pointing towards the apex of the leaf, even in the basal leaflets. The fronds are also rather narrower in outline, and their ultimate divisions are rather broader and less parallel-sided. The involucres are more exserted, a little larger, and with longer convex and entire valves. The cells of the fronds are longer and narrower than in H. Tunbridgense. Mr. Gulliver gives the average size of the cells of H. Tunbridgense as $\frac{1}{571}$ inch each way, and in H. unilaterale, the average long diameter $\frac{1}{308}$ inch, and the short diameter $\frac{1}{615}$ inch. (See 'Journ. Bot.' 1865, p. 294.) Mr. F. Clowes states that the fronds of H. Tunbridgense die annually, while those of H. Wilsoni grow on from year to year, like those of Trichomanes radicans, but Mr. Moore says the fronds of H. Tunbridgense endure for "two or three years under favourable circumstances." ('Nat. Print. Ferns,' 8vo. ed. vol. ii. p. 304.) I have not had H. Tunbridgense in cultivation, but I can corroborate the statement that the fronds of H. unilaterale live for more than one year.

Wilson's Filmy Fern.

SUBORDER III.—**POLYPODIACEÆ.**

Sporangia with an incomplete vertical annulus, and opening by a transverse slit on the side where the annulus is incomplete.

TRIBE I.—POLYPODIEÆ.

Rootstock growing in advance of the fronds, the stipes of which is articulated to the rootstock, and separates from it, leaving a distinct scar. Sori roundish or more or less elongated, attached to the back of the veins, without an indusium.

This is the only tribe of British Ferns belonging to Mr. John Smith's division *Eremobrya*, which is characterised "Fronds solitary, solitary, lateral, and articulate with its caudex;" all the following tribes belong to his division *Desmobrya*, and have the "fronds terminal, solitary, fasciculate, adherent to the caudex." (J. Smith, 'Hist. Filicum,' pp. 61–79.) I agree with the late Mr. E. Newman ('Phytologist,' ser. 1, vol. v. p. 229) that such plants as Pteris aquilina, which have a rhizome growing in advance of the fronds, cannot naturally be referred to Desmobrya; though I cannot go so far with him as to join them with Polypodium and the other Eremobrya. Probably Pteris aquilina and such Ferns as have a rhizome growing in advance of the fronds, but the rachis of the fronds continuous with the rhizome and not articulated to it, ought to be formed into a separate division to be placed between *Eremobrya* and *Desmobrya*—as natural primary divisions of the suborder Polypodiaceæ.

GENUS IV.—**POLYPODIUM.** *Linn.*

Rootstock scaly, growing in advance of the fronds. Fronds solitary, their stipes articulated to the rootstock. Veins free. Sori roundish, rarely oval, terminating the lower anterior veins. Indusium absent.

Name from πολύς (*polus*) many, and πούς (*pous*) *foot.*

SPECIES I.—**POLYPODIUM VULGARE.** *Linn.*

PLATE 1842.

Bab. Crypt. Vasc. Europ. Exsicc. No. 1544.
Ctenopteris vulgaris, *Newm.* Phyt. 1851, App. p. 29; Brit. Ferns, ed. iii. p. 42.

Rootstock thick, at first densely clothed with peltately attached reddish-brown ovate-triangular and lanceolate acuminate or cuspidate scales, which are toothed on the margins. Fronds petiolate, coriaceous, evergreen, not scurfy, glabrous when full grown, strap-shaped or oblong-strapshaped or lanceolate- or ovate-oblong, acuminate at the apex, abrupt at the base, very deeply pinnatipartite; segments strap-shaped or lanceolate, with broad adnate bases, usually indistinctly crenate or serrate, more rarely deeply crenate or serrate or pinnatifid. Secondary veins forked, or with 1 to 4 alternate lateral veins below the terminal fork, the ultimate veins not reaching the margin. Sori round or roundish, arranged in a line on each side of the segment, and about midway between it and the margin, attached to the extremity of the first anterior branches of the secondary veins. No barren fronds differing in shape or division from the fertile fronds.

Var. α. *genuinum.*

Stipes containing a single vascular bundle. Frond strap-shaped, gradually acuminate at the apex; segments strapshaped or oblong-strapshaped, obtuse or abruptly acute, rarely attenuated from near the middle to the apex, very finely crenate-serrulate. Secondary veins usually with 1 lateral vein below the terminal fork, or more rarely only forked.

Var. β. *serratum.* Willd.

Stipes containing 2 vascular bundles. Frond oblong-strapshaped, often abruptly acuminated at the apex; segments strapshaped or lanceolate-strapshaped, gradually acuminated, more or less distinctly serrate or crenate, serrate at the margins. Secondary veins usually with two lateral veins below the terminal fork.

Var. γ. *Cambricum.* Willd.

P. Cambricum, *Linn.* Spec. Plant. p. 1546.

Stipes containing two vascular bundles. Fronds lanceolate- or ovate-oblong, abruptly acuminated; segments lanceolate or elliptical, irregularly pinnatifid, or some of them pinnatifid and on the same frond, others serrate or crenate-serrate, or rarely all crenate, often barren. Secondary veins with 2 or 3 lateral veins below the terminal fork, or elongated so as to form midribs to the secondary segments, in which case they give off simple or once-forked veins.

On rocks, walls, steep banks, stumps of trees. Common, and generally distributed in England, Scotland, and Ireland.

Var. β is much more rare, at least in Scotland. I have it from

Cheshire from the Rev. W. W. Newbould; Godalming, Surrey (H. C. Watson and Henry Bull). Mr. Moore gives stations in Kent, Surrey, Sussex, Somerset, Devon, Cornwall, Monmouth, Hereford, Warwickshire, Gloucester, Oxford, Worcester, York, Pembroke, Denbigh, Kirkcudbright, Stirling, Galway, Clare, Waterford and Guernsey.

Of var. γ the typical Cambricum was originally found in a wood near Dinas-Powys Castle, Cardiff, Glamorganshire. Said by Mr. Lowe to have been found recently in a wood near Macclesfield, Cheshire; also reported from Kidderminster, Mill Dingle, Beaumaris, Conway Castle, Ambleside, and Antrim. A fertile form of it was found at Goderich Castle, Herefordshire by Mr. W. Bennett, from whom I have cultivated specimens. Forms still less divided I have from Killarney, and it has been observed in various parts of Ireland, especially Kerry, Clare, and Wicklow. In the south and west of England.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Var. α has the rootstock varying from the thickness of a goosequill to that of a man's little finger, usually creeping along the surface on which it grows, to which it adheres by numerous branched densely tomentose radical fibres; it is branched, and the growing apex is always in advance of the fronds, thickly clothed with pale reddish-brown scales, which ultimately fall off, and leave the rhizome smooth and green. Upon this part of it there are elevated warts, the top of which exhibits a circular depression; this is the scar left by the stipes which have separated from the rootstock by an articulation. The scales with which it is covered are remarkable for adhering by a large surface, so as to be peltate, they are dentate on the margins and on the long apical cusp; the teeth are prominent and distant, spreading, or even a little recurved at the point. The stipes is from 1 to 8 inches long, pale green, cylindrical, with an inconspicuous green ridge on each side, about as thick as a stocking wire, at first furnished with distant lanceolate acuminate cuspidate brown scales, like those on the rootstock, but soon becoming quite bare. Lamina usually more or less channelled from the segments bending inwards; 2 to 10 inches long by 1 to 2½ inches broad, dark green, paler and somewhat glaucous beneath, with the veins more translucent than the rest of the frond, and clubbed at the apex, unrolling at the end of May or first half of June, but the sori are not completely developed till a month or six weeks afterwards, when they are become yellow or bright orange, and about the size of sago grains or larger; they are often produced on the apical portion only of the frond. The spores are pale yellow, oblong-reniform, bluntly tuberculate. The fronds remain green until the following summer, except in exposed localities; they are erect, or pendent when luxuriant.

Var. β is usually a larger plant, the fronds 6 to 20 inches long, 3 to 5 inches broad.

Var. γ has the fronds 4 inches to 1 foot long, by 3 to 7 inches broad. It is to this variety that the handsomest forms, so much coveted by fern-growers, belong. Most of these, however, are abnormal developments, which is shown by the frond being either wholly or partially barren, and by the irregularity of the divisions of the primary segments. The most regular of all the forms, which is also occasionally fertile, is that from Goderich Castle, Herefordshire, which is named "*omnilacerum*" by Mr. Moore. The true *Cambricum* is always barren. The form called *crenatum* by Mr. Wollaston, which I have from Mucrus, Killarney, appears to be really the *Cambricum* without monstrous development. This comes very near var. β. *serratum*, but has the frond much broader in proportion. Mr. Moore gives Saltoun Castle, Kent (S. Grey); Devonshire (Rev. J. M. Chanter); Conway (Dr. Alchin); Ruthin, Denbigh (E. Pritchard); the Craigs, near Dumfries (W. G. Johnson); Mucrus, Killarney (Dr. Alchin); as stations for the form *crenatum*. (Moore, 'Nat. Print. Ferns,' 8vo. ed., vol. i. p. 67.)

Common Polypody.

TRIBE II.—GRAMMITIDEÆ.

Caudex not growing in advance of the fronds, the stipes of which is not articulated to the caudex, and does not separate from it. Sori elongated or linear, or more rarely nearly round, attached to the back of the veins, without an indusium.

GENUS V.—**GYMNOGRAMME.** *Desv.*

Fronds produced from the apex of the caudex, usually approximated or tufted; stipes not articulated to the caudex. Veins forked, free. Sori linear or oblong, rarely roundish, on the back of the ultimate veins, and often occupying their whole length, frequently ultimately confluent, not covered by the reflexed margins of the frond. Indusium absent.

Name from γυμνός (*gumnos*) naked, γραμμή (*gramme*) a line, referring to the naked lines often formed by the sori which are not covered by an indusium.

SPECIES I.—**GYMNOGRAMMA LEPTOPHYLLA.** *Desvaux.*

PLATE 1843.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 81.
Grammitis leptophylla, *Swartz & Willd.* Spec. Plant. Vol. V. p. 143. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 629.
Polypodium leptophyllum, *Linn.* Spec. Plant. 1553.

Caudex minute, annual, or rather biennial, with filiform scales. Fronds of two forms on the same plant. Fertile frond, with the stipes usually as long as or longer than the lamina, maroon-coloured at the base, at first with a few capillary scales, ultimately naked. Lamina pale yellowish-green, membranous, glabrous when full grown, without scales or powder beneath, oblong or lanceolate-oblong, abrupt at the base, acuminate, bipinnate; pinnules obovate, pinnatisect or flabellately lobed, wedge-shaped or inversely deltoid at the base, with the lobes once or twice dichotomous; ultimate divisions very short and rounded. Sori oblong, ultimately confluent, and covering the upper half of the lobes of the pinnules. Sterile frond smaller, and with a much shorter stipes than the fertile frond. Lamina thinner than in the fertile frond, ovate, pinnate; pinnæ shortly stalked, larger than in the fertile frond, flabellate, dichotomously incised, in luxuriant plants not unfrequently bearing sori, which are rounder than in the fertile frond, and not confluent. Fertile fronds deciduous; barren ones fugacious.

On banks and walls facing the south or south-west in Jersey. The first notice of it was published in the 'Gardeners' Chronicle,' Jan. 29th, 1853, p. 69, by "J. M.," who appears to have found it not only in that year, but in the previous one in Jersey. Mr. Newman, in March 1853, states that he learned from his friend Mr. Henry Hagen, in the winter of 1852–3, that a lady had discovered Gymnogramme leptophylla in one of the Channel Islands, and on receipt of a specimen he announced the fact in the 'Phytologist,' 1853, p. 914. As a result of communications received May, 1853, he intimated that it was reported from Jersey that Gymnogramme was widely distributed in the island, preferring localities in which the moistened soil induces the growth of *Marchantia*, in company with which plant it appears particularly to flourish; it also occurs, but not so frequently, growing in moss. The principal localities are near Le Haule, near St. Aubin's, and in several places near St. Laurence. On the 25th of June, 1853, I gathered the Gymnogramme on the right-hand side of the road from Goose-green to St. Laurence; it was about $\frac{1}{4}$ mile from Goose-green, on a high bank, looking towards the south-west, faced up with stones, in the interstices of which it grew; it was far past its prime, and much of it quite dried up. Before it was ascertained to occur in Jersey, it was reported from Aberdeenshire. Mr. W. W. Spicer published in the 'Phytologist' for 1862, p. 600, a letter from Miss Veitch, in which she states she discovered it "in a stone dyke on the high-road, on the right-hand side, leading from Braemar to Ballater, nearly opposite Invercauld House, and as far as I remember where the highlanders perform their annual feats at the gathering, viz., a rock called 'the Lion's Face,' at the foot of which, enclosing trees, is the above-named dyke." No one else, however, has found the plant in this station, and it is scarcely conceivable that it could exist in so cold a climate. Doubtless some mistake has been made.

Channel Islands. Annual or biennial. Spring.

Caudex very minute, roundish, simple, sending out woolly root-fibres with from 4 or 5 fronds in the Jersey specimens, which vary from 1 to $2\frac{1}{2}$ inches high. In Portuguese specimens there are sometimes 8 or 9 fronds with the tallest 6 to 8 inches high. The fronds which are first produced are sterile; the earliest of these is not above $\frac{1}{4}$ or $\frac{1}{2}$ inch long, and has a roundish trifid lamina with dichotomously lobed segments; the succeeding fronds are longer and more compound, but still are only accidentally fertile; the pinnæ of these are about $\frac{1}{4}$ inch long. The fertile fronds have a much longer and stouter stipes; they are much more decompound, pale green, thin, soon becoming tinged with olive-yellow; the primary rachis is very narrowly winged, with a herbaceous stripe running from each pinna; the rachides of the pinnæ are much more broadly winged, sometimes so much so that the pinnæ cannot be said to be more than pinnatipartite. In very luxuriant specimens the pinnules are again pinnatipartite, but in the small specimens, such as those I have seen from Jersey, they cannot be termed more than lobed, and are about $\frac{1}{8}$ inch long. The sori are yellowish, and before coalescing appear as if forked; this arises from their being continued along the course of the veins from the last fork down to their apex, which is a little within the margin of the segment. Spores dark brown, areolate. The stipes contains a single reniform vascular bundle; the hair-like scales are at first white, afterwards brown.

According to Moore, in the wild state we learn that the prothallus is developed in the damp late autumnal months, being perfectly formed in November; by January 3 or 4 fronds have been produced, in April or May the growth is mature, and by August the plants have perished. Sometimes in cultivation the perfect fronds are not produced till the second year."—'Nature Printed Ferns,' 8vo. ed. vol. i. p. 110.

Annual Maidenhair.

GENUS VI.—CRYPTOGRAMME. *R. Brown.*

Fronds produced from the upper part of the caudex, approximate, dimorphous, the fertile fronds contracted; stipes not articulated to the caudex. Veins forked or simple, free. Sori roundish or oval, at the extremity of the ultimate veins, ultimately confluent so as to form a submarginal line covered by the reflexed margin of the frond. Indusium absent. Sterile frond with the margins not reflexed.

Name from κρυπτός (*kruptos*) hidden, and γραμμή (*gramme*) a line, on account of the lines of sori being concealed by the reflexed margin of the frond.

CRYPTOGRAMME CRISPA. *R. Brown.*

PLATE 1844.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 42.

Allosorus crispus, *Bernhardt.* *Newman*, Brit. Ferns, ed. iii. p. 35. *Moore*, Nat. Print. Brit. Ferns, 8vo ed. Vol. I. p. 100. *Milde*, Fil. Europ. p. 23. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 95. *Fries*, Summ. Veg. Scand. p. 83. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 641. *Rabenh.* l. c.

Pteris crispa, *Linn. ms.* Eng. Bot. No. 1160; and Eng. Fl. Vol. IV. p. 19.

Osmunda crispa, *Linn.* Spec. Plant. p. 1522.

Rootstock shortly creeping, dividing into numerous crowns. Fronds of two forms on the same plant. Fertile frond with the stipes usually twice as long as the lamina, sparingly furnished with lanceolate scales when young, ultimately naked. Lamina triangular-ovate or ovate, firm, pale green, ultimately yellowish-green, glabrous, tripinnate or more rarely bipinnate or quadripinnate; the ultimate pinnæ shortly stalked, or contracted towards the base, oblong elliptical fusiform or oblong-cylindrical, with the margins recurved and nearly concealing the sori, which are ultimately confluent. Sterile frond with the stipes usually twice as long as the lamina. Lamina membranous, firm, bright green, deltoid-ovate or triangular-ovate, 2 or 3 times pinnate, the ultimate pinnæ obovate or oblanceolate, wedge-shaped at the base, incised or toothed with the teeth blunt; the veins running into the teeth, but not quite reaching their apex. Both kinds of frond deciduous.

On rocks and walls, and among loose stones and on hillsides. Local and principally found in mountainous districts. Challicomb, near Simmonsbath, Somerset; it also occurs in Shropshire, Worcestershire, Derbyshire, Glamorganshire and Cardiganshire. In North Wales it becomes abundant, and still more so in the Lake district. In Scotland it is much more generally distributed, extending north to Caithness, Sutherland and the Hebrides, but it is not recorded from Orkney or Shetland. In Ireland it is very rare, and confined to the east and north-east.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex dividing into a great number of small crowns massed closely together, so that though each crown produces but few fronds, the plant grows in large tufts. Stipes of fertile fronds, 3 to 10 inches high, slender, wiry, brown at the base, then yellowish-green. Lamina 1½ to 4 inches long; ultimate segments ⅛ to ⅜ inch long, bearing a superficial resemblance to a pod of a Draba. Stipes of sterile frond 1¼ to 5 inches long; lamina 1½ to 4 inches; ultimate segments variable in the shape of and in the degree in which they are incised, varying from ⅛ to ¼ inch long.

Occasionally barren fronds are found with the ultimate segments, but slightly sinuated at the edges and not cut. These appear to be transition forms between the barren and the fertile fronds. It is certainly not a variety, for I have a specimen in which, from the same caudex, one of these fronds is produced along with the ordinary barren fronds with deeply cut pinnules, and fertile fronds of the usual form.

The fronds are produced in May or the beginning of June, and are killed by the first severe frost of autumn. It cannot be mistaken for any other British Fern, on account of its dimorphous decompound bright green crisped fronds.

The name of Parsley-fern is given on account of the barren fronds having some resemblance to those of garden Parsley (Petroselinum sativum). They are, however, more like those of Fool's Parsley (Æthusa Cynapium).

Parsley-fern, or Rock-brakes.

TRIBE III.—ASPIDIEÆ.

Caudex or rootstock not growing in advance of the fronds, the stipes of which is not articulated to the rootstock, and does not separate from it. Sori punctiform, round, very rarely elongated, attached to the back of the veins, generally furnished with an indusium which assumes various forms, but is never attached to the veins longitudinally; rarely the indusium is absent.

GENUS VII.—**PHEGOPTERIS.** *Fée.*

Fronds produced from the extremity of the caudex and its branches, solitary or approximate, membranous, once or more times pinnate; stipes not articulated to the caudex. Veins forked or pinnate, free. Sori punctiform, round, rarely oval or linear, at the extremity of the ultimate veins or attached to some portion of their back. Indusium absent.

Name from φηγός (*phegos*) a Beech, and πτέρις (*pteris*) a Fern. The Beech-fern is the type of the genus.

SPECIES I. **PHEGOPTERIS DRYOPTERIS.** *Fée.*

PLATE 1845.

Rabenh. Crypt. Vasc. Exsicc. No. 57.

Polypodium Dryopteris, *Linn.* Spec. Plant. 1555. *Sm.* Engl. Bot. No. 616, and Brit. Fl. Vol. IV. p. 282. *Bab.* Man. Brit. Bot. ed. vii. p. 445. *Hook. fil.* Stud. Fl. p. 467. *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 85. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 974. *Fries*, Summ. Veg. Scand. p. 82.

Polypodium Dryopteris, var. α. genuinum, *Ledeb.* Fl. Ross. Vol. IV. p. 509. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 628. *Hook. & Baker*, Syn. Fil. ed. ii. p. 309.

Lastrea Dryopteris, *Bory. Newm.* Brit. Ferns, ed. ii. p. 13.

Gymnocarpium Dryopteris, *Newm.* Phytol. 1851, p. 371, and App. xxiv.; and Brit. Ferns, ed. iii. p. 57.

Caudex elongate, very slender, wiry, creeping, branched, not tortuous, not tomentose, the younger portions clothed with ovate scales, producing fronds at rather distant intervals. Fronds all similar. Stipes erect, almost filiform, much longer than the lamina, glabrous, at first with a few ovate or lanceolate often piliferous pale scales, ultimately naked. Lamina suddenly bent back at nearly a right-angle with the stipes, so as to appear almost horizontal when growing, bright pea-green, membranous, rather flaccid, glabrous and without glands, deltoid, acute, ternately bi- or tripinnate, with the three main divisions of which the frond is composed each rolled up into a separate ball in vernation; ultimate pinnules or segments flat, oblong, obtuse, crenate-serrate or entire. Sori round, arranged in a line near the margin on each side of the pinnules or ultimate segments, attached to the lateral veins a little below their apex.

On rocks and amongst stones, chiefly in ravines, and on the ground in damp woods. In the south of England it is very rare, and probably in some of its reported stations P. Robertianum has been mistaken for it. There is, however, good authority for its occurrence in

East Cornwall, North Devon, West Gloucester, Hereford, Worcestershire and Shropshire, as well as both North and South Wales; from Lancashire, Derbyshire, and Yorkshire, it occurs in almost every county north to Caithness and Sutherland, and may certainly be called frequent in Scotland. It is not recorded from Orkney, but it is from Shetland. In Ireland it is very rare, and the only recent authority which is beyond question is that on Knocklayd Mountain, Antrim, where it was found about the height of 1800 feet by Dr. Moore; Benoo Mountain, near Manor Hamilton, Leitrim, where it was found by the late Mr. J. Wynne; and near Loch Talt, on the Ox Mountain, Sligo (Mr. P. Warren).

England, Scotland, Ireland. Perennial. Summer, Autumn.

Rootstock pitchy black, about the thickness of a stocking-wire, creeping just under the surface of the leaf-mould or loose soil in which it grows, emitting numerous capillary root-fibres sparingly clothed with very short down; the growing extremity and young branches of the rhizome are completely covered with ovate, very pale brown scales, which disappear from the older portions of the caudex; when the plant is luxuriant, the rhizomes and their branches interlace and form a sort of loose tangle. Fronds few in number, proceeding from the two sides of the caudex alternately, usually from $\frac{1}{2}$ inch to 1 inch apart. Rachis 6 inches to 1 foot high, very slender, bluntly channelled on the upper half on the front, containing 2 vascular bundles. Lamina $2\frac{1}{2}$ to $5\frac{1}{2}$ inches by $3\frac{1}{2}$ to 8 inches broad, with a few pairs of distant opposite pinnæ, the lower pair so much larger than any of the others that the frond might be termed ternate with each of its 3 divisions bipinnate. These lowest pinnæ have their pinnules, especially the basal ones, much more developed on the lower side than on the upper; the lowest pinnæ of all the 3 divisions have their lowest pinnules separated from succeeding pairs, but towards their apex the pinnæ coalesce; the same thing takes place with the pinnules of these pinnæ, of which the basal ones are separate, but the apical ones cohere, so that the apex of each of the 3 main divisions and of the tips of the lower subdivisions are only lobed or toothed—not pinnate. The lowermost of these ultimate pinnules or subdivisions are more or less deeply crenate-serrate, the upper ones entire; each one has a midrib, which is flexuous towards the apex, and gives off veins which run to the margin of the pinnule or lobe; these veins are simple, or the lower ones once or even twice-forked. The fronds begin to be produced early in May, and very soon attain their full size, so that mature sporangia may be found in June. The sporangia are at first yellow, they are minute and sometimes ultimately nearly coalesce so as to form submarginal lines upon the segments. The fronds perish with the first frost. When growing in shade they are of a rich vivid green, but not at all shining. In exposed places they frequently become tinged with red. They are very delicate in texture, and soon wither if after being gathered they are exposed to the air.

Properly speaking, this Fern produces no barren fronds distinct from the fertile ones; still we frequently meet with fronds fully developed without sori. These have the pinnæ broader and ultimate pinnæ more approximate, and a greater number of them combined than the fertile fronds, so that they appear to be less divided, but they occur too rarely to be considered more than an accidental variation.

Oak-fern.

SPECIES II.—PHEGOPTERIS ROBERTIANA. *A. Braun.*

PLATE 1846.

Rabenh. Crypt. Vasc. Exsicc. No. 58.

Ph. calcarea, *Fée*, Gen. Fil. p. 243. *Rabenh.* l.c.

Polypodium Robertianum, *Hoffm.* *Bab.* Man. Brit. Bot. ed. vii. p. 445. *Hook. fil.* Stud. Fl. p. 467. *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 92. *Koch*, Syn. Fl. Germ. et Helv. p. 974. *Fries*, Summ. Veg. Scand. p. 82.

Polypodium calcareum, *Sm.* Engl. Bot. No. 1525; and Eng. Fl. Vol. IV. p. 283.

Polypodium Dryopteris, *β*. Robertianum, *Ruprecht.* *Led.* Fl. Ross. Vol. IV. p. 509. *Hook. & Bak.* Syn. Fil. ed. ii. p. 309.

Polypodium Dryopteris, *β*. calcareum, *Gr. & Godr.* Fl. de Fr. Vol. III. p. 628.

Lastrea Robertiana, *Newm.* Hist. Brit. Ferns, ed. ii. p. 13.

Lastrea calcarea, *Bory*, Dict. Class. Hist. Nat. Vol. IX. p. 233.

Gymnocarpium Robertianum, *Newm.* Phyt. 1851, p. 371, and App. 24; and Brit. Ferns, ed. iii. p. 63.

Caudex elongate, slender, wiry, tortuous, creeping, branched, flocculently tomentose, the younger part thickly clothed with ovate scales, producing fronds at rather short intervals. Fronds all similar. Stipes erect, wiry, longer than the lamina, minutely glandular, at first with numerous ovate or lanceolate often piliferous pale scales, ultimately naked. Lamina curved backwards, firm, dull greyish-green, sprinkled with very minute stalked glands, which are most numerous on the rachis partial rachides and mid-veins, deltoid or triangular-deltoid, bipinnate, acuminate, and very acute; ultimate pinnules or segments often convex with reflexed margins, oblong, obtuse, crenate or entire. Sori round, arranged in a line near the margin on each side of the pinnules or ultimate segments, attached to the lateral veins a little below their apex.

On limestone rocks, local. It occurs in Somersetshire, Wiltshire, Oxford, Bucks, Gloucester, Hereford, Stafford, Salop, Glamorgan, Brecon, Denbigh, Derby, Lancaster, York, Durham. Besides these counties it has been reported from Worcestershire, Carnarvon, and Cumberland. It grows in the Isle of Wight, at Swainston, and Carisbrooke Castle, but not wild. It has been found in an old quarry near Aberfeldy: concerning this station, Dr. Buchanan White says it is now nearly eradicated, but was once abundant; he adds that he once suggested, half in jest, that the spores might have been accidentally carried with workmen's tools from some limestone quarry in England. Mr. Watson also gives No. 93, i.e. North Aberdeen, as a Scotch station, which is insufficiently vouched for, but possibly correct. ('Top. Bot.,' p. 489.) It seems remarkable that it should be absent from the limestone hills of Ireland.

England, Scotland ? Perennial. Summer.

Rootstock pitchy black, about the thickness of a straw or more. Fronds several, $\frac{1}{8}$ to $\frac{3}{4}$ inch apart. Stipes 4 to 10 inches long. Lamina $3\frac{1}{2}$ to 9 inches long, by 3 to 8 inches broad. Lower pair of pinnæ much larger than the succeeding ones, and more remote from them than any of the other pairs or than the portion of their partial rachis which is between its junction with the main rachis and its first pair of pinnæ; they are, however, not so much larger than the other pairs of pinnæ as to give the frond a ternate appearance, and they are not rolled up into little balls separate from the one into which the rest of the lamina is coiled in bud. The fronds appear in May and perish with the first frost. I have not seen any fully developed barren fronds of this species analogous to those mentioned under P. Dryopteris.

P. Robertiana has been often confounded with P. Dryopteris, and indeed even now some botanists regard them as varieties of a single species. To me they appear abundantly distinct, and it is surprising that any one who has seen the two plants alive could combine them. P. Robertiana differs from P. Dryopteris in having the caudex considerably thicker, more woody, and more tortuous, the younger portions more thickly clothed with scales and with brownish tomentum, which comes off in flakes, leaving the old portions of the rootstock glabrous; the root-fibres are also stronger and more tomentose. The fronds are more numerous, much closer together, and (when young) with many more scales. The stipes is much thicker, and firmer, and glandular, at least when young. The lamina is not suddenly bent back at its junction with the stipes as in P. Dryopteris, but curves backwards gradually; it is longer in proportion to its breadth, much more acute, rather less compound, with the pinnules less approximate and more of them separated; it is of a dull greyish tint—very different from the vivid green of P. Dryopteris. The very minute stalked-glands with which it is clothed, give it a somewhat dusty appearance, and furnish a character by which it may be distinguished in the dried plant; they are most abundant on the rachis and midrib. The ultimate divisions are often more or less convex, from having their edges recurved like those of some forms of Athyrium Filix-femina. The sori are larger, and from this sometimes become confluent so as to form continuous lines. Lastly, the constitution of the plant seems quite different, for P. Dryopteris loves shade and moisture, while P. Robertianum prefers dry spots and full exposure to the sun.

Limestone-Fern, Smith's-Fern, or Limestone Polypody.

SPECIES III.—**PHEGOPTERIS POLYPODIOIDES.** *Fée.*

PLATE 1847.

Rabenh. **Crypt. Vasc. Europ. Exsicc. No. 56.**

Ph. vulgaris, *Mett.* Fil. Hort. Bot. Lips. p. 83.

Polypodium Phegopteris, *Linn.* Spec. Plant. p. 1550. *Sm.* Eng. Bot. No. 2224; and Eng. Fl. Vol. IV. p. 282. *Bab.* Man. Brit. Bot. ed. vii. p. 441. *Hook. fil.* Stud. Fl. p. 467. *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 70. *Hook. & Baker*, Syn. Fil. ed. ii. p. 308. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 974. *Fries*, Summ. Veg. Scand. p. 82. *Gren. & Godr.* Fl. de France, Vol. III. p. 627. *Rabenh.* l. c.

Lastrea Phegopteris, *Bory*. *Newm.* Hist. Brit. Ferns, ed. ii. p. 13.

Gymnocarpium Phegopteris, *Newm.* Phyt. 1851, p. 371, and at p. 23; and Hist. Brit. Ferns, ed. iii. p. 49.

Caudex elongate, slender, scarcely tortuous, creeping, branched, tomentose, the younger parts sparingly clothed with lanceolate scales, producing fronds at rather distant intervals. Fronds all similar. Stipes erect, almost filiform, finely pubescent, at first with rather numerous lanceolate or subulate often piliferous pale brown scales, ultimately naked. Lamina gradually curved backwards, firm, dull yellowish-green, sparingly pubescent, triangular-acuminate and very acute, pinnate with the pinnæ pinnatifid or pinnatipartite but not again pinnate; lower pair of pinnæ deflexed; ultimate segments often convex, oblong, obtuse, crenate or entire. Sori round or oval, arranged in a line near the margin on each side of the ultimate segments, but commonly only towards their base, attached to the lateral veins a little below their apex.

On rocks and amongst stones, chiefly in ravines, and on the ground in damp woods. This plant has almost the same distribution as P. Dryopteris, in company with which it often grows. There are, however, a few more localities in the south of England, as it occurs not only in Cornwall and Devon, but also in Dorset and Sussex. In Scotland it occurs in Orkney, where P. Dryopteris has not been noticed, although it, as well as P. Phegopteris, has been observed in

Shetland. In Ireland it is rather local and rare, but widely distributed from south to north.

England, Scotland, Ireland. Perennial. Summer.

Caudex very similar to that of P. Dryopteris, but thicker, and finely pubescent. This pubescence is more persistent than that on the caudex of P. Robertianum, and does not come off in flocculi, as in that plant; the hairs, too, are considerably shorter. The scales on the caudex are considerably narrower, more acute, and darker coloured than in P. Dryopteris. The fronds are $\frac{1}{4}$ to 1 inch apart. The stipes is 3 to 12 inches long, thicker than that of P. Dryopteris, and like it very brittle, but is not so thick as that of P. Robertianum; at first it is pitchy at the base, and usually with a good many scales similar to those on the caudex, while those above are narrower; it is also sparingly clothed with very minute whitish spreading or reflexed hairs. The lamina is 3 to 8 inches long by 2 to $5\frac{1}{2}$ inches broad; the rachis and midrib of the pinnæ are clothed with minute narrowly subulate whitish scales, as well as minute hairs. The texture of the frond is much firmer than in P. Dryopteris, but less so than in P. Robertianum, and it is also intermediate in colour between the two. The pinnæ are more or less deeply pinnatifid or pinnatipartite, at least towards the base. The first pair of pinnæ, which are as long as, or nearly as long as, the second pair, are directed slightly downwards, so as to form acute angles with the succeeding pair, and are not parallel to them. The uppermost pinnæ are combined, so that the apical half of the frond is pinnatipartite, not pinnate. The sori are usually less numerous than in P. Robertianum and P. calcareum, and are often more or less oval.

Beech Fern, or Mountain Polypody.

GENUS VIII.—**LASTREA.** *Presl.*

Fronds produced from the extremity of the caudex, approximate and tufted or solitary, membranous or subcoriaceous, once or more times pinnate; stipes not articulated to the caudex. Veins all free. Sori punctiform, round, at the extremity of the ultimate veins, or attached to some portion of their back. Indusium round or reniform, with a sinus at the base, by which it is attached; rarely the indusium is absent or fugacious.

Name after the Chevalier de Lastre, a French botanist and microscopist.

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SPECIES I.—LASTREA THELYPTERIS. *Presl.*

PLATE 1848.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 16.
L. palustris, *J. S. Milde*, Hist. Fil. p. 266.
Nephrodium Thelypteris, *Desv.* *Hook. fil.* Stud. Fl. p. 466. *Hook.* & *Bak.* Syn. Fil. ed. ii. p. 271.
Aspidium Thelypteris, *Schwartz.* *Sm.* Eng. Fl. Vol. IV. p. 285. *Fries*, Summ. Veg. Scand. p. 82. *Rabenh.* l. c.
Polystichum Thelypteris, *Roth*, Syn. Fl. Germ. et Helv. ed. ii. p. 917. *Gren.* & *Godr.* Fl. de Fr. Vol. III. p. 630.
Polypodium Thelypteris, *Linn.* Mant. Pl. p. 505. *Sm.* Engl. Bot. No. 1018.
P. palustre, *Salisb.* Prod. 403.
Acrostichum Thelypteris, *Linn.* Sp. Pl. 1528.
Thelypteris palustris, *Schott*, Gen. Fil. sub T. 10 in note.
Hemestheum Thelypteris, *Newm.* Phyt. 1851. App. xxii.; and Hist. Brit. Ferns, p. 124.

Caudex very long, slender, wiry, creeping, much branched, the youngest portion with a few ovate obtuse pale very deciduous scales. Fronds of 2 kinds, produced at distant intervals along the rhizome, either solitary, or (in luxuriant plants) a few together in small fascicles, deciduous. Fertile fronds erect, with the stipes as long as, or longer than, the lamina, slender, slightly channelled in the upper part, containing 2 vascular bundles, pitchy-black at the base, with a very few pale ovate-acuminate scales, which soon fall off and leave the stipes naked. Lamina firm, yellowish-green, almost without glands (at least when full grown), oblong or strapshaped-oblong, abrupt at the base, rather abruptly acuminated into an acute apex, pinnate; pinnæ all shortly stalked, triangular-strapshaped, pectinate-pinnatifid or -pinnatipartite; ultimate segments convex, narrowly triangular-strapshaped or triangular-oblong, more or less falcate, acute, entire, with recurved margins. Ultimate veins running from the midrib to the margins of the segments, forking near their base, those towards the apex of the segment generally simple. Rachis not scaly, or rarely with a few ovate brown scales. Sori attached to the back of the ultimate veins, forming a line on each side of the mid-vein about half-way between it and the margins of the segments, more or less covered by the recurved margins, ultimately confluent all over the lower surface of the segments. Indusium hyaline, soon disappearing, reniform, with minute stalked glands round the margin. Spores muricated. Sterile fronds produced earlier than the fertile ones, less erect, and not so tall. Stipes usually shorter than the lamina. Lamina bright green, membranous, oblong or ovate-oblong, acuminated, abrupt at the base, very shortly stalked, deeply pinnatifid; first pair of pinnæ elongate, but a little shorter than the succeeding pair; ultimate segments oblong, sometimes slightly falcate, obtuse or subacute, entire or repand, flat. Ultimate veins mostly once forked, but the basal ones sometimes branched below the fork, and the terminal ones simple.

In bogs and marshes. Local, but widely distributed in England, from Devon, Dorset, Hants, Sussex, and Kent, to Northumberland and Cumberland. In Scotland it is confined to Forfarshire, where it grows about Rescobie, and formerly at Restennet. It is reported from Scalloway and Guendal, Dunrossness, Shetland, but most likely this is a mistake. Local and rare, but widely distributed in the west, centre, and north of Ireland.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex very long, creeping at a short distance below the surface of the loose peaty soil in which the plant grows, and extending rapidly when the conditions favourable for its growth occur; it is about the thickness of a straw, nearly black, with very numerous radical fibres, which are at first tomentose, afterwards glabrous. The fronds are produced alternately, 1½ to 2 inches apart, in this respect resembling those of the British species of Phegopteris, but there is this difference between them, that in luxuriant plants the fronds, instead of being produced singly at the nodes of the caudex, are in small fascicles, sometimes as many as 5 or 6 being found together. The barren fronds are the first to appear, about the month of May, the fertile ones not for a month or six weeks afterwards. The fronds continue to develop during the whole season, until stopped by the advent of frost, which kills both barren and fertile fronds. The stipes is from the thickness of a stocking-wire to that of a crow-quill, much longer and stouter in the fertile than in the barren fronds. These are 7 inches to 2 feet long; the lamina is 6 to 18 inches long, by 3 or 4 inches broad; the ultimate segments are ¼ to ⅜ inch long. In the sterile fronds the stipes varies from 3 to 9 inches long, and the frond is from 3 to 15 inches, and from 2 to 6 inches broad; the ultimate segments are ¼ to ½ inch long, commonly contiguous, so that the pinnæ have not the pectinated appearance of those of the fertile fronds. This is no doubt in great measure owing to the segments of the latter being recurved; but even when the latter are flattened out, they are narrower than in the barren fronds. In both the fertile and barren fronds, but especially in the latter, the first pair of segments is often larger than the others, and the pinnules are separated almost down to the midrib of the pinna, but this is by no means always so.

The indusium is extremely thin, and very quickly disappears, after which the sori appear to be as naked as in the genus Phegopteris. The young fronds have generally a few glands, especially beneath, but these can rarely be detected in fully matured fronds; they are sessile, and yellowish, situated chiefly along the back of the midribs of the pinnæ. Sometimes a few very minute whitish hairs are to be found on the rachis and lamina. I have not seen British specimens with the segments cut, but Milde gives a var. "pinnatifidum," from Silesia, in which the laciniæ are irregularly pinnatifid.

Marsh-fern, or Female Buckler-fern.

SPECIES II.—LASTREA OREOPTERIS. *Presl.*

PLATE 1849.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 39.

L. montana, *Newm.* Hist. Brit. Ferns, ed. iii. p. 130. *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 170.

Nephrodium Oreopteris, *Desv.* *Hook. fil.* Stud. Fl. p. 466.

N. montanum, *Baker.* *Hook. & Bak.* Syn. Fil. ed. ii. p. 271.

Aspidium Oreopteris, *Swartz*, Summ. Veg. Scand. p. 82. *Rabenh.* l.c. *Sm.* Eng. Fl. Vol. IV. p. 286. *Fries.*

A. montanum, *Ascherson.* *Milde*, Fil. Europ. p. 115.

Polystichum Oreopteris, *DC.* *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 978. *Gr. & Godr.* Fl. de Fr. Vol. III. p. 631.

P. montanum, *Roth*, Fl. Germ. Vol. III. p. 74.

Polypodium Oreopteris, *Ehrh.* *Sm.* Eng. Bot. No. 1019.

P. montanum, *Vogler*, non *Lamarck.*

Hemestheum montanum, *Newm.* Phyt. 1851, App. p. xxii.

Caudex short, thick, separating into numerous crowns, which are also thick and shortly creeping or decumbent, and covered by the imbricated bases of fronds. Fronds all similar, several produced close together from the extremity of each crown, erect or inclined outwards, deciduous. Stipes very short, stout, channelled on the anterior face in the upper part, containing 2 vascular bundles, glandular, with numerous ovate-acuminate pale scales which are partially persistent. Lamina firm, bright green, glandular beneath, oblanceolate or elliptical, gradually and longly attenuated towards the base, gradually acuminate and acute at the apex, pinnate; lower pinnæ deltoid, very short, those in the middle and apex of the frond triangular-strapshaped; all of them sessile, pinnatifid or pinnatipartite; ultimate segments flat, oblong or oval-oblong, sometimes slightly falcate, obtuse, entire or faintly crenate, with the margins not recurved. Ultimate veins running from the midrib to the margins of the segments, forking near their middle, those towards the apex of the segment generally simple or all of them simple. Sori attached to the back of the ultimate veins, forming a line on each side of the main vein a little within the margin of the segment, which is not recurved over them. Indusium hyaline, soon disappearing, irregularly roundish, with minute stalked glands round the margin, generally imperfect or malformed, and frequently entirely absent. Spores granulated. No sterile fronds dissimilar to the fertile ones.

In pastures and woods, especially in hilly districts. Generally distributed in England, but sparingly so, except in Wales and the north of England. In Scotland it is frequent, and very abundant throughout the highlands, extending north to Orkney and Shetland. In Ireland it is local, and rather scarce, though it is found from the north to the south of the island.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex dividing into branches from the thickness of a man's finger to nearly that of his wrist, that is taking into account the brown decayed bases of the stipites with which it is clothed; sometimes these branches are so short that the plant grows in a great tuft with numerous crowns, but usually, when growing in light soil, the crowns are quite detached, and seem like separate plants until the caudex is laid bare by digging, when they will be found connected. Stipes slightly dilated at the base, where there is a more or less evident rib on each side extending for a short distance upwards, above this the stipes is rounded, with the exception of a rather deep furrow on the anterior surface, which is continued along the rachis to the apex of the frond. The fronds are ordinarily 2 feet high, but vary from 7 inches to 4 feet, of which the stipes occupies only from 1 to 6 inches, the breadth is from $2\frac{1}{4}$ to 10 inches; they begin to unfold in May, and perish with the first severe frost in autumn. There does not appear to be a continued succession of fronds as in L. Thelypteris, for I have not noticed young fronds appearing later than the end of July. In their young state they are of a delicate pea-green with the scales white and hyaline. They have a peculiarity in their mode of unfolding: the pinnæ unroll themselves before the rachis uncurls, so that as the latter developes the pinnæ attached to the unfolded portion have already straightened themselves; the end of the rachis goes on unfolding to the apex. The mature fronds are more or less firm, especially so when growing in exposed situations, but in moist shady woods they are often flaccid; in this case they are of a bright pure green, or even dark green, but on exposed hillsides they are more of a yellow green. The pinnæ diminish in length rapidly towards the base of the frond, and the lower ones are more distant from each other; the consequence of this is to give a very long and gradual taper to the base of the lamina. The sori are placed very near the margin of the segments; they are either distinct or coalesce in a line, but do not cover the whole of the lower surface of the frond, but are always most numerous in the apical half of the frond.

There seem to be no true varieties of this Fern. In 1872 I brought a plant of it from Glen Cloy, Arran, which was the ordinary form with entire segments; in 1878, it is much more robust than it has ever been, and had the edges of the segments conspicuously crenate and undulated too, so it is now what I suppose Mr. Moore calls *crispa.* The breadth of the segments also varies a good deal. There are a few monstrosities, but none of them very striking.

Strangely enough, L. Oreopteris appears to have been sometimes mistaken for L. Thelypteris; it differs by its thick short caudex, with the fronds of each crown arranged like the feathers of a shuttlecock, by its short scaly stipes and its frond greatly attenuated at the base, and, when fertile, with the margins of the segments not recurved so as to cover the sori, also by the minute yellow glands, which are sprinkled over the under surface of the frond, and which give it a pleasant scent.

There is some difficulty in deciding whether this Fern ought to be called Oreopteris or montana. There is no agreement amongst botanists as to the limitation of the genera of Ferns, the characters on which the genera ought to be founded being still an undecided question. Very possibly the microscopical structure may afford more natural characters than any at present employed. The lower the plant is in its organisation, the more permanent are the form and structure of the cells and the tissue into which they are combined. It is now generally admitted that the form and disposition of the leaf-cells of Mosses can be advantageously employed as generic characters, while in Ferns the presence or absence and even the shape of the indusium is admittedly liable to variation, and genera founded on characters taken from it present the most incongruous groups. In consequence of this want of agreement as to generic names it has become a general rule that the specific name shall not be changed, and that the first specific name applied to a Fern shall be retained in whatever genus it is afterwards placed. Seeing, then, that the generic name is unstable, and the specific name unchanging, it has become very general, not only amongst fern-growers, but amongst botanists in this country, to speak of Ferns by the specific names only. We speak of Dryopteris, Filix-mas, Filix-femina, etc., without using generic names at all, except in the few cases where the generic name has proved stable and consists of but a single British species, as Osmunda or Scolopendrium, in which it is usual to use the generic name alone. The same practice arising from the same cause occurs in entomology, where in certain groups of moths but a single name is employed, as 'Betularia,' 'Viridana,' etc. The late Mr. Newman, in the 5th edition of his 'British Ferns,' designates nearly all the Ferns by but a single Latin name. Of course this use of a single name can only be practicable provided there be not two British Ferns with the same specific name. In 1781 Vogler gave the name Polypodium montanum to the plant just described, for which I have retained the name Lastrea Oreopteris although it was not until 1789 that Ehrhart named it Polypodium Oreopteris: but, according to Milde, Lamarck had previously (1778) applied the name Polypodium montanum to the Fern now known as Cystopteris montana. Mr. Newman, who adopted the name "montana" instead of "Oreopteris," used the name myrrhidifolia for Cystopteris montana, as it was named Polypodium myrrhidifolium by Villars in 1875, considering that the name montanum was given to it by Allioni in 1785, which would make Allioni's P. montanum later than Vogler: but Vogler's P. montanum is really later than Lamarck's. Linnæus seems to have confounded P. Oreopteris with his P. fragrans, and Hudson, in the 2nd edition of his 'Flora Anglica,' gave it the name of Polypodium fragrans, but this has no claim to be retained.

Mountain Fern.

SPECIES III.—LASTREA FILIX-MAS. *Presl.*

PLATE 1850.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 23.

Nephrodium Filix-mas, *Richard. Hook. fil.* Stud. Fl. p. 465. *Hook. & Bak.* Syn. Fil. ed. ii. p. 272.

Aspidium Filix-mas, *Swartz. Sm.* Eng. Bot. ed. i. No. 1458, and Eng. Fl. Vol. IV p. 288. *Fries*, Summ. Veg. Scand. p. 82. *Rabenh.* l. c. No. 23.

Polystichum Filix-mas, *Roth. Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 978. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 631.

Polypodium Filix-mas, *Linn.* Spec. Plant. p. 1551.

Dryopteris Filix-mas, *Schott. Newm.* Hist. Brit. Ferns, ed. iii. p. 184.

Lophodium Filix-mas, *Newm.* Phytol. 1851, Append. p. 20.

Caudex short, very thick, separating into few large divisions or crowns, which are also very thick, short or rather short, and decumbent or more rarely erect, covered by the imbricated bases of former fronds. Fronds all similar, many produced close together from the extremity of each crown, erect or inclined outwards, deciduous or sub-evergreen. Stipes short or rather short ($\frac{1}{10}$ to $\frac{1}{5}$ of the length of its lamina), very stout, flattened or very slightly channelled on the anterior face, containing 5 or 7 or more vascular bundles, without glands or with a few glands beneath, with very numerous lanceolate acuminate entire or denticulate often ciliated pale or dark brown glabrous or slightly glabrous scales, which are partially or wholly persistent. Lamina firm or subcoriaceous, bright green, usually without glands, oblong or strapshaped or oblong-elliptical, gradually or suddenly acuminate or cuspidate, rather abrupt at the base, bipinnate or once pinnate with the pinnæ pinnatipartite or deeply pinnatifid; lowest pair of pinnæ triangular-strapshaped or triangular, shorter than the succeeding pair, but not very greatly so; all of them very shortly stalked or subsessile, pinnate or pinnatipartite or pinnatifid, flat or concave; pinnules or ultimate segments oblong or strapshaped-oblong, or the basal ones triangular-oblong, scarcely at all falcate, decurrent on the posterior side of the base, obtuse or subacute, serrate or crenate-serrate, especially towards the apex, more rarely inciso-serrate or even pinnatifid throughout, at least in those nearest the rachis, with the margins not recurved over the sori; the serratures sharp, but not spinous, pointed. Ultimate veins running from the midrib to just within the margin of the segments, with one or more with branches, according to the size of the lobes into which they run, one branch at least of each vein running into a tooth. Sori confined to the pinnæ of the upper half or third of the frond attached to the back of the anterior fork of the ultimate veins, forming a line on each side of the main vein rather more approximate to it than to the margins of the pinnule or segment, usually confined to the lower two-thirds of the pinnule, and sometimes on the basal lateral veins only. Indusium firm or subcoriaceous, persistent, reniform or roundish-reniform, convex, often very greatly so, glabrous or sprinkled with minute glands over the whole surface. Spores granulated. No sterile fronds dissimilar to the fertile ones.

Var. α. *genuina*.

Fronds erect. Stipes short; scales rather numerous, subdiaphanous, ultimately pale brown, slightly ciliate or pectinate-ciliate, the lowest ones broadly lanceolate, the upper ones linear, intermixed with a few rather flexuous hair-like ones, the greater number of them falling off early and leaving the rachis nearly naked. Lamina firm, bright green with very pale brown subhyaline scales when it is unfolding, ultimately rather dull green, a little paler beneath where it is sometimes sparingly glandular on the rachis, narrowly oblong or strapshaped-oblong, pinnate; pinnæ all narrow, flat or rarely concave, and all, except a few pairs near the base, pointing towards the apex of the frond, and so making an acute angle with the rachis, pinnate or pinnatipartite (at least towards the base); pinnules or ultimate segments contiguous, oblong, attached by a base broader than the rest of the pinnule or segment, scarcely tapering towards the obtuse apex, crenate-serrate or entire, flat or (in small specimens) with the apices slightly incurved. Indusium rather large, regularly convex, with the margins not incurved round the sporangia, glabrous. Spores with a few rather large rounded separate tubercles.

Var. (?) β. *affinis*. Bab.

L. Filix-mas, var. incisa, *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 177.

Nephrodium Filix-mas, var. affine, *Hook. fil.* Stud. Fl. p. 495; and *Hook. & Bak.* Syn. Fil. p. 272.

Aspidium affine, *Fischer & Meyer* in *Hohenäcker*, Enum. Plant. quas itin. per prov. Talysch leg. 1838, p. 10. *Milde*, l.c.

Polystichum affine, *Ledebour*, Fl. Ross. Vol. IV. p. 515.

Dryopteris affinis, *Newm.* Nat. Hist. Brit. Ferns, ed. iii. p. 187.

Fronds commonly arching backwards, at least when large. Stipes rather short; scales rather numerous, diaphanous pale brown, slightly ciliate, the lowest ones broadly lanceolate, the upper ones linear, intermixed with numerous flexuous-like ones, almost all falling off early and leaving the rachis naked. Lamina rather flaccid, bright glistening green, with white hyaline scales when it is unfolding, ultimately bright green, a little paler beneath, where it is not glandular even on the rachis, broadly elliptical-oblong or oblanceolate-oblong, pinnate; lowest pinnæ broader than the others and more triangular, and as well as those up to the middle of the frond spreading or even decurved, all of them flat, pinnate; pinnules not contiguous, strap-shaped or the lower ones triangular-strapshaped, attached by a base which is narrower than the lower part of the pinnule, inciso-serrate, or some of them near the base even pinnatifid, with the serrature sometimes again serrate, tapering towards the subobtuse or subacute apex, flat. Indusium rather large, regularly convex, with the margins not incurved round the sporangia, glabrous. Spores with a few small rather inconspicuous separate tubercles.

Var. γ. *paleacea*. Moore.

L. pseudo-mas, *Wollaston*, Phyt. ser. ii. 1855, p. 172. *Lowe*, Nat. Ferns, Vol. I. p. 280.

L. Filix-mas, var. Borreri. *Bab.* Man. Brit. Bot. ed. vii. p. 447.

Nephrodium Filix-mas, var. Borreri, *Hook. fil.* Stud. Fl. p. 465.

Aspidium paleaceum, *Don*, Prod. Fl. Nepaul, p. 4.

A. patentissimum, *Wallich*, Cat. p. 340.

A. Donnianum, *Spreng.* Syst. Veg. Vol. IV. pp. 2, 320.

A. Wallichianum, *Spreng.* Syst. Veg. Vol. IV. p. 101.

A. parallelogramum, *Kunze*, Linnea, Vol. XIII. p. 146.
A. crinitum, *Martius & Galeotti*, Foug. Mex. p. 66.
A. adnatum, *Blume*, Enum. Fil. Ger. p. 62.
Dichasium patentissimum, *A. Braun*, Fl. 1841, p. 710.
D. parallelogramum, *A. Braun*, Fl. 1841, p. 710.
(I rely on Dr. Milde and Mr. Moore for the above synonyms. See Nat. Print. Brit. Ferns, 8vo. ed. pp. 178-179.)
Dryopteris Borreri, *Newm.* Hist. Brit. Ferns, ed. iii. p. 189.

Fronds erect. Stipes rather short; scales very numerous, firm, at first brown, ultimately dark fulvous or maroon, generally with a maroon-coloured spot or stripe at the base, ciliate, the lowest ones broadly lanceolate, the upper ones linear, intermixed with very numerous firm hair or bristle-like ones, almost all persistent so that the rachis is permanently scaly. Lamina subcoriaceous, yellowish-green tinged with olive, with bright fulvous scales when it is unfolding, ultimately dark green, conspicuously paler and sometimes subglaucous beneath, where it is not glandular even on the rachis, oblong or narrowly elliptical-oblong, pinnate; lowest pinnæ very slightly broader than the others, and as well as those in the middle of the stem spreading at right angles to the rachis or slightly pointing towards the apex of the frond, pinnate, all of them flat or slightly concave; pinnules contiguous, strapshaped or oblong-strapshaped, attached by a base which is commonly broader than the rest of the pinnule, or in very luxuriant specimens narrower than the lower part of the pinnule, not tapering to the very obtuse apex, faintly crenate-serrate, or rarely inciso-serrate, flat or with the apices slightly bent inwards. Indusium small, very convex, with the margins incurved over the sporangia, glabrous. Spores with a few rather large blunt separate tubercles.

Var. (?) δ. *pumila*. Moore.

"Aspidium Filix-mas, var. recurvum, *Francis*, Anal. Brit. Ferns, p. 36," teste *Newman*, Hist. Brit. Ferns, ed. iii. p. 193.

Fronds inclining backwards. Stipes very short; scales numerous, rather thin, pale ferruginous concolorous, fimbriate-ciliate, studded with a few minute glands, the lower ones lanceolate, the upper ones linear, intermingled with rather numerous flexuous hair-like ones, most of them subpersistent so that the rachis is permanently more or less scaly. Lamina subcoriaceous, bright green with very pale scales when it is unfolding, afterwards dark green, only slightly paler beneath, where it is minutely glandular elliptical or oblong-elliptical, pinnate; lowest pinnæ a little broader and more triangular than the others, and as well as those near the bottom of the stem deflexed; the rest spreading at right angles, pinnatipartite or pinnatifid, more or less concave; pinnules or ultimate segments contiguous or overlapping, oblong, attached by a base which is wider than the rest of the segment, not tapering to the very obtuse apex, crenate-serrate or inciso-serrate, more or less twisted, and with the apices bent inwards. Indusium small, very convex, with the margins incurved over the sporangia, sprinkled all over with minute glands. Spores with numerous minute contiguous tubercles.

Var. ε. *abbreviata*. Bab.

L. abbreviata, *Wollaston*, Phyt. 1855, p. 172.
L. propinqua, '*Wollaston*.' *Lowe*, Nat. Ferns, Vol. I. p. 280 (1865) (non *Presl* and *J. Smith*).
Nephrodium Filix-mas, var. abbreviatum, *Hook. fil.* Stud. Fl. p. 465?
Aspidium abbreviatum, *Poiret*, Encyc. Bot. Suppl. Vol. I. p. 516?
A. Filix-mas, var. glandulosum, *Milde*, Fil. Europ. p. 123.
Polystichum abbreviatum, *DC.* Fl. Fr. Vol. II. p. 560?
P. Filix-mas, var. abbreviatum, *Gren. & Godr.* Fl. de Fr. Vol. III. p. 631?
Dryopteris abbreviata, *Newm.* Hist. Fil. ed. iii. p. 192?

Fronds inclining backwards. Stipes very short; scales numerous, rather thin, pale ferruginous concolorous, fimbriate-ciliate, studded with numerous minute glands, the lower ones ovate-lanceolate, the upper linear, intermingled with a few flexuous hair-like ones, most of them deciduous, so that ultimately the rachis is nearly naked. Lamina firm but scarcely subcoriaceous, bright green, with very pale scales when it is unfolding, afterwards rather dull green, only slightly paler beneath, where it is thickly and minutely glandular, oblong or narrowly oblong, pinnate; lowest pinnæ scarcely broader than the others, and as well as those about the middle of the lamina spreading nearly at right angles to the rachis, the uppermost ones inclining a little towards the apex of the frond, pinnate, slightly concave; pinnules not contiguous, strapshaped-oblong, attached by a base which is narrower than the rest of the segment, tapering scarcely or but slightly to the obtuse apex, inciso-crenate or serrate, with the crenatures often again crenate, very slightly twisted and with the apices slightly bent inwards. Indusium small, very convex, with the margins incurved round the sporangia, sprinkled all over with minute glands. Spores with very numerous and very minute contiguous tubercles.

Var. α, common in pastures or heaths, and by roadsides, rarely in woods, generally distributed in England, Scotland, and Ireland.

Var. β, common in woods and bushy places, more rarely in open ground, but generally distributed.

Var. γ, in open ground and woods, common and probably generally distributed, extending north to Orkney, where I have seen it at Ramsdale, Orphir, and in Firth.

Var. δ, apparently rare, and according to Mr. Moore "it seems confined to North Wales and to alpine localities," Snowdon (Mr. D. Cameron), and Llysgwyn (Mr. S. O. Gray). I have a specimen from Teesdale, collected by the late Mr. A. O. Black; this is named *abbreviata*, but it is not the plant intended by me under that name. Probably some of the stations for *abbreviata* belong to what I regard as *pumila*. The plant growing in Scalpa Bay seems to be Moore's crispa, which I refer to *pumila*. Var. *subintegra*, Moore, I have not seen, but judging from descriptions, it must be referred to *pumila*; it was gathered at Ennis, county Clare, Ireland.

Var. ϵ, apparently scarce. Langdale (Mr. G. B. Wollaston); Borrowdale, Cumberland (Mr. R. D. Harrison), judging from plate of *abbreviata cristata* of Lowe's 'Native Ferns.' Ashurst Park, Tunbridge Wells (Mrs. Bolland), judging from figure 188 of Lowe's 'Native Ferns.'

England, Scotland, Ireland. Perennial. Summer, Autumn.

Very variable in size, according to its place of growth. Var. α has a stout caudex, with a few short decumbent divisions about the thickness of a man's wrist; the fronds are 9 inches to 3 feet high, by 3 to 8 inches wide; the stipes is stout (in large specimens the size of a goose-quill), 3 to 7 inches long, and contains at least 5 vascular bundles, generally 7, and near the base often a greater number. The sori occupy the apical half or two-thirds of the frond. Rachis unrolling in advance of the pinnæ, the apex of the frond hanging down like a shepherd's crook, afterwards becoming erect.

Var. β is probably merely a nemoral form of var. α; it grows to a much larger size, often 4 or 5 feet high, or even more, by 9 to 15 inches broad, or even more. The stipes is 6 inches to 1 foot long. The texture of the frond is thinner, more shining, and is less rigid than var. α; the pinnules are more separated, more tapering, much more strongly serrate or incised, and often those near the base of the lower pinnæ are pinnatifid or pinnatipartite, with the divisions again serrate. The indusia, however, are rather smaller if not absolutely at least comparatively, and the sori are generally less numerous, not occupying such a large part of the apical portion of the frond. The spores of the specimens I have examined are smaller, and with less elevated tubercles.

Var. γ is a firmer and more upright plant than either of the preceding; it is about a week or ten days later in unfolding its fronds in spring than the plants of the other form growing side by side with it, and it bears a greater degree of frost; for although in Fife it is always killed by the winter's frosts on exposed hillsides, in woods the fronds survive the winter, and, unless broken down by snow, remain upright as well as green until early spring; while var. α growing with it hardly ever survives as long as the new year, and even if the fronds remain green till then, the stipes, which is weaker, gives way, and they lie flat on the ground. The much greater number of scales on the stipes and rachis, and their persistence, is also a marked feature; but perhaps the most striking is the shape of the indusium. In all forms of Filix-mas the indusium is firmer, more convex, and more persistent, than in any other British Fern: but in var. *paleacea* these characters are most pronounced. In vars. *genuina* and *affinis* the free or anterior margin of the indusium is not incurved; it looks like a watch-glass over the sporangia, with the notch where it is attached to the vein not reaching the middle of the indusium, and represented by a shallow pit connected by a furrow with the reniform posterior margin. In var. *paleacea* the free margins are incurved, and the notch extends further into the indusium, so that it is not merely reniform in outline, but actually resembles a miniature sheep's kidney with the ends brought together. In size it varies much, according to its place of growth. I have Monmouthshire specimens in good fruit less than a foot long by 4 inches broad, and in woods at Balmuto it grows 5 feet long by 1 foot broad, with a stipes the thickness of a man's little finger, and containing 11 vascular bundles when cut halfway between the caudex and the beginning of the lamina. I much regret that the name *Borreri*, by which the plant is generally known in this country, cannot be retained, in accordance with the rigid rules of Fern-nomenclature, as Don described it under the name of Aspidium paleaceum, fifty-one years before Newman published it as Dryopteris Borreri.

Var. δ. *pumila* much resembles a dwarf form of *genuina*, but the scales are more numerous and darker. The chief distinction lies in the minute glands, with which not only the under-surface of the frond but even the indusium is dotted. I have no authentic wild specimens. The cultivated plant I obtained from Messrs. Sang, nurserymen, Kirkcaldy, and believe it to be correctly named. It has fronds 6 or 7 inches long by 2 broad, and is remarkable for the extreme shortness of the stipes, which is only ½ to 1 inch long. The points of the pinnæ are bent upwards and slightly twisted, so as to give a crisped appearance to the frond. Mr. Black's Teesdale specimens, which I refer to *pumila*, are 8 or 9 inches long by 3 inches broad, with petioles about 1¼ inch long. Both of these have but from 1 to 3 sori on each pinna or ultimate segment, so that they are in a row on each side of the midrib, which appears to be one of the characters relied on to distinguish the var. *abbreviata* from ordinary Filix-mas. But this is simply the effect of depauperisation. Starved plants of vars. *genuina* and *paleacea* may be found in the same condition : when such do produce sori, the difference can only be relied on as an evidence that *pumila* and *abbreviata* belong to a smaller form or race than vars. α, β, and γ; for these three when so small as ordinary wild specimens of vars. *pumila* and *abbreviata* produce no sori at all. The form called crispa by Mr. Moore seems the same as a plant which I gathered at Scalpa, and is much more robust than *pumila*, being from 8 to 18 inches high. The 8-inch specimens have mostly but 1 or 2 sori on each pinnule, while the larger examples have 6 or 8 on the basal ones. It has much the habit of *paleacea*, but has scales like those of pumila, and glandular fronds and indusia. It is remarkable for its crowded overlapping pinnules, which are imbricated one over the other, the anterior edge of each being turned upwards. Each pinnule has its edges reflexed, so that it is convex on the upper side, but the apex is bent upwards, so that the pinna, taken as a whole, is concave.

Var. ε agrees with *pumila* in its very short rachis and numerous glandular scales with toothed margins, thicker and darker-coloured than those of vars. *genuina* and *affinis*, but thinner and less bristly than those of *paleacea*. The fronds and the indusia have more numerous glands than in var. δ. *pumila*; the pinnules, at least towards the base of the pinnæ, are separate from each other, and much less twisted. The lower pair of pinnæ are not so much shorter than the succeeding pair, and the frond when fully developed is more parallel-sided, and thinner in texture and of a yellower green. Indeed, but for the short stipes and firmer indusium they might be mistaken for those of L. rigida by a casual observer. A cultivated plant which I had from Messrs. Sang, of Kirkcaldy (who got it from the late Dr. Lyell, of Newburgh) has the fronds 10 to 15 inches long by 3 to 5 inches broad, and the stipes 1 to 2½ inches long; but others received from Mr. Wollaston, originally from Langdale, have the fronds 3 feet 6 inches long and 7 inches broad; and the stipes 5 or 6 inches long. Mr. Moore says ('Nat. Print. Brit. Ferns,' 8vo. ed., vol. i. p. 129), "Indusium fringed with glands." But I have never seen this; they are *dotted* with glands, but not fringed.

Mr. Lowe says of his *abbreviata* that "specimens would have readily divided into no less than 20 distinct plants, and this seemed to be quite a character of the variety." I have not had the opportunity to verify this record, which would make *abbreviata* a multiceps form, not a pauciceps form, as ordinary Filix-mas.

Mr. G. B. Wollaston, who has paid great attention to the Ferns of the Filix-mas group, thinks there are 3 distinct species included under this name: 1, L. Filix-mas, which includes vars. *genuina* and *affinis*; 2, L. pseudo-mas, equivalent to var. *paleacea*; and 3, L. abbreviata (Phyt. 1855, p. 172) or L. propinqua (Lowe, 'Native Ferns,' vol. i. p. 234). Apparently his abbreviata in the 'Phytologist' included the var. *pumila*, but in Lowe's 'Native Ferns' *pumila* is arranged under pseudo-mas (Lowe, l. c. p. 280).

If we had merely the forms affinis, paleacea and abbreviata, I should certainly have described them as subspecies, but with vars. *genuina* and *pumila* the chief forms are so connected that I am unable to separate them as subspecies.

The present species is readily distinguished from L. Oreopteris by having the frond much less tapered towards the base, and the sori remote from the margins of the pinnules. The indusium is very different, being firm, reniform, and persistent.

L. Filix-mas is one of the Ferns which delight fern-growers, from the number of abnormal forms of the fronds which occur. Some of these, which have the ends of the pinnæ and apex of the stem cleft, are extremely beautiful, while others in which the pinnæ are much reduced are at least curious, if not beautiful.

The caudex of the male fern has long had a reputation as an anthelmintic or vermifuge. The caudex must be gathered between the end of May and the middle of September, and after being dried in the shade, powdered and kept in well-closed bottles. The powder loses its virtue if kept much longer than a year.

Male-fern, or Male Shield-fern.

SPECIES IV.—**LASTREA RIGIDA.** *Presl.*

PLATE 1851.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 89.
Nephrodium rigidum, *Desv.* *Hook. fil.* Stud. Fl. p. 465. *Hook. & Bak.* Syn. Fil. ed. ii. p. 275.
Aspidium rigidum, *Swartz.* *Hook.* in Suppl. Eng. Bot. No. 2724. *Milde*, Fil. Europ. p. 126. *Fries*, Summ. Veg. Scand. p. 82. *Rabenh.* l. c. No. 89.
A. fragrans, *Gray*, Nat. Ar. Brit. Pl. p. 9.
Polystichum rigidum, *DC.* *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 979. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 632.
P. strigosum, *Roth*, Tent. Fl. Germ. p. 86.
Polypodium rigidum, *Hoffm.* Deutschl. Fl. Vol. II. p. 6.
P. fragrans, *Villars*, Hist. Plant. Dauph. Vol. III. p. 43, non *Linn.*
Lophodium fragrans, *Newm.* Phyt. 1851, App. p. xxi.
L. rigidum, *Newm.* Hist. Brit. Ferns, ed. iii. p. 176.

Caudex short, stout, thick, separating into numerous small divisions, which are moderately thick, very short, and closely packed together, closely covered by the imbricated bases of former fronds. Fronds all similar; several produced close together from the extremity of each crown, erect or ascending, deciduous. Stipes rather long (one-fifth as long to nearly as long as the lamina), rather stout, flattened or only slightly channelled on the anterior face, even in the upper part containing 5 vascular bundles, thickly sprinkled with minute sessile glands, and rather thickly clothed with numerous lanceolate or ovate-lanceolate acuminate denticulate brown conspicuously glandular scales, which are subpersistent, or more rarely partially or wholly persistent. Lamina firm, dull greyish-green, thickly sprinkled with glands on both sides at least when young, strapshaped-oblong or narrowly triangular-oblong, tapering gradually to the apex, very abrupt at the base, bipinnate; lowest pair of pinnæ triangular or triangular-strapshaped, about as long as any of the succeeding pairs, all of them shortly stalked, pinnate, flat or slightly concave; ultimate pinnules oblong or oblong-strapshaped, or strapshaped-triangular, scarcely falcate, not decurrent on either side of base, obtuse or sub-acute, pinnatifidly lobed, with the lobes serrate, the serratures generally very sharp but not spinous-pointed. Ultimate veins running from the midrib to just within the margins of the lobes or ultimate segments of the pinnules, with each venule running into a tooth. Sori placed on the pinnæ of the upper half or two-thirds of the frond, attached to the back of the anterior venule of the ultimate lobes, forming a line on each side of the main vein of the pinnules considerably more approximate to it than to the margin of the pinnule, extending nearly to the apex of the pinnules, sometimes at the base of the pinnules, also on 2 or more branches of the vein. Indusium firm, persistent, roundish-reniform, convex, often very much so, sprinkled with conspicuous glands over the whole surface. Spores bluntly tuberculate with a few large blunt tubercles. No sterile fronds dissimilar to the fertile ones.

On rocks and amongst broken limestone in mountainous districts, very local. Silverdale, near the top lock, Lancaster and Kendal Canal, North Lancashire; Allermine rocks, above Settle; south-east side of Ingleborough; White Scars, above Ingleton, Yorkshire; Arnside Knot, Hutton Roof Craigs, and Farlton Knot, Westmoreland; and indeed over the whole tract between Arnside Knot and Ingleborough. It is recorded from Wolston Moss, near Warrington, Mr. W. Christy, but this requires confirmation. A single plant was found near Bath, probably planted; and it has been gathered in Ireland, on a clay slate wall near Towaly, Drogheda, no doubt planted (Cyb. Hib.).

England, [Ireland]. Perennial. Summer, Autumn.

Stipes from the thickness of a crow-quill to that of a goose-quill, 3 inches to 1 foot long; in the latter case (a plant from Ingleborough collected by Mr. Baker) the lamina is 14 inches long and 5 inches broad; in another Ingleborough specimen from the late Mr. A. O. Black, the rachis is 10 inches long, and the frond 14 inches by 5 inches. The colour and texture of the lamina is not unlike that of Polypodium Robertianum, no doubt on account of the small whitish glands with which the plant is so thickly sprinkled even on the upper side. The under side of the frond is much paler than the upper. The scales on the lower part of the stipes vary from ovate-lanceolate to lanceolate; those on the upper part of the stipes, rachis, and secondary rachides are much narrower. The pinnæ are spreading or ascending-spreading, and do not decrease in size towards the base, indeed the lowest pair is frequently actually longer than the succeeding pairs. The pinnules are not contiguous, the lower ones at least attached by a narrow base, which is frequently more or less auricled on account of their lowest lobes being larger than the rest, they taper slightly towards the apex. They are conspicuously fringed with minute stalked glands. Indusia yellow, but ultimately appearing lead-colour from the dark-coloured sporangia showing through, as in Filix-mas.

L. rigida is not unlike the *abbreviata* form of Filix-mas, but has a much longer stipes, a more opaque frond, which is very much more glandular, and is more abrupt at the base from the great size of the lower pair of pinnæ. The indusia are thinner, less deeply notched and with much larger and more conspicuous glands, which are evidently stalked. The multiceps caudex is very different from that of any form of L. Filix-mas I have seen.

I am indebted to Mr. Charles Bailey, of Manchester, for a living plant from Arnside Knot.

Rigid Shield-fern.

SPECIES V.—LASTREA REMOTA. *Moore.*

PLATE 1852.

Nephrodium remotum, *Hook. fil.* Stud. Fl. p. 466.
N. spinulosum, var. remotum, *Hook. & Bak.* Syn. Fil. ed. ii. p. 275.
Aspidium remotum, *A. Braun.* *Milde,* Fil. Europ. p. 125.
A. rigidum, *β.* remotum, *A. Braun* in *Döll.* Fl. Rheinl. p. 16.
" A. Filix-mas, var. elongatum, *Hook.* Spec. Fil. Vol. IV. p. 117." *Milde.*

"Caudex stout, unusually upright" (Clowes, in lit.). Fronds all similar, erect, "deciduous" (Lowe). Stipes rather long (about one-fourth the length of the lamina), channelled on the anterior face, containing 7 vascular bundles, without glands and with very numerous scales, the lowest of which are ovate, acuminate or cuspidate and pale brown, the upper lanceolate intermixed with hair-like ones; these two last commonly having a darker shade in the centre towards the base; all of them more or less persistent. Lamina firm, bright green, without glands, elliptical-strapshaped or strapshaped-oblong, rather abruptly acuminate and rather abrupt at the base, bipinnate; lowest pair of pinnæ triangular-strapshaped, shorter than the succeeding pair, but not very much so, all of them shortly stalked, pinnate, flat; pinnules oblong or oblong-elliptical, or the basal ones triangular-lanceolate, not falcate, not decurrent on either side of the base, subobtuse or subacute, the basal ones pinnatipartite, with the lobes serrate at the apex, the others inciso-serrate; serratures very sharp, but not spinous-pointed. Ultimate veins running from the midrib to just within the margins of the lobes or ultimate segments of the pinnules, once forked or simple, with each posterior venule running into a tooth. Sori occupying the whole of the frond, attached to the back of the anterior venule of the ultimate lobes, or on the largest lobes to two or three of the lowest ultimate venules of the lobe, forming a line on each side of the main vein of the pinnules, much nearer to it than to the margin of the pinnules, extending nearly to the apex of the pinnules. Indusium rather firm, persistent, roundish-reniform, erose on the margins, without glands. Spores bluntly tuberculated. No sterile fronds dissimilar to the fertile ones.

Windermere, Westmoreland; first observed by Mr. Isaac Huddart growing in company with L. Filix-mas, vars. *incisa* and *abbreviata*, L. spinulosa, and L. dilatata, and about 5 miles from limestone rocks, where L. rigida is abundant. (Mr. Frederick Clowes in Phyt. 1860, p. 227.)

England. Perennial. Autumn.

Frond resembling in outline that of L. Filix-mas, var. *genuina*, but with a longer stipes, 3 to 4 feet high, of which the stipes is 9 inches to 1 foot long. Pinnæ pointing upwards at an acute angle, longest in the middle of the frond, the longest 5 or 6 inches long; pinnules in the middle of the frond $\frac{1}{2}$ to 1 inch long.

L. remota differs from L. Filix-mas in its longer stipes and more compound fronds. The pinnules are not contiguous and are attached by a narrow base to the partial rachis; they are nearly equally cut in on both the anterior and posterior sides, so that the basal ones are almost stalked, with a tendency to be broadest near the middle or a little below it, and are so deeply pinnatipartite that the frond becomes almost tripinnate. The partial rachis is winged, with a narrow herbaceous stripe connecting the pinnules, which are less decidedly opposite than those of L. Filix-mas; and the lobes of the pinnules have a more decided mid-vein giving off branches than even var. *affinis* of L. Filix-mas, though it does obtain to some extent in the more divided forms of that variety; even in these, however, the pinnules, except those at the bottom of the pinnæ, are narrowed at the base only on the anterior side and decurrent on the posterior side. In L. remota the sori are placed in a line which is much closer to the midrib of the pinnules than in L. Filix-mas. The scales also are different, being more varied in form on the same individual, and those at the base of the stipes are broader. The indusium is smaller, thinner in texture, and with the depression of the notch less marked than in Filix-mas, and the edges are finely denticulate.

From L. rigida it differs in its much longer fronds, which have the basal pinnæ conspicuously smaller than the succeeding ones, and all of them making a much smaller angle with the rachis. The pinnules are much larger, and are not to be auricled at the base, as is so frequently the case with L. rigida; and there is an absence of the conspicuous glands with which the rachis scales, upper and under sides of the lamina and indusia are studded. The ultimate veins are more clavate at the apex than in any of the preceding species of Lastrea.

Its difference from L. spinulosa will be noticed under that species.

Of this plant I have seen no living specimens, nor do I possess dried native specimens. I have received dried cultivated specimens from Windermere, from Mr. G. B. Wollaston, through the kindness of Messrs. F. Currie and C. E. Broome; and also from Messrs. E. Sang and Sons, Kirkcaldy, who had the frond from Mr. Lowe, of Nottingham. The caudex and vernation I am therefore unable to describe from personal experience; but Mr. F. Clowes writes concerning the former, "A single crown of it, if let alone, will grow up like a tree-fern, and requires support to prevent it being broken by the wind." In his paper in the 2nd ser. of 'Phytologist,' 1860, p. 220, of the vernation he says, "Forms side loops like spinulosa; tip not so disengaged as to form the 'shepherd's crook';" and of the pinnæ he says, "Lower ones obliquely triangular from the greater length of posterior basal pinnules; the surface more or less twisted upwards." Here we have two additional differences from Filix-mas in which the well-known "shepherd's crook," formed by the top uncurling frond, is particularly observable and forms a marked feature (though it is said to be imperfectly formed in var. *abbreviata*), while the second point is the twisting of the pinnæ as in L. spinulosa and L. uliginosa, so that their plane does not coincide with that of the frond as a whole, which it does in Filix-mas.

Milde says that the original discoverer of this plant, the late Professor A. Braun, now (1867) considers this plant a form of Filix-mas; but Milde himself inclines to the opinion that it is a hybrid between Filix-mas and spinulosa; and Mr. Clowes writes, "I have no doubt that L. remota of Moore and Braun is a hybrid. It has been sown over and over again, and always produced L. Filix-mas, *var. paleacea.* I do not know whether L. dilatata or spinulosa has ever come up from its spores; but as the plant called L. remota has never come from its spores, I cannot think it a species or variety. I do not know whether it is a hybrid between L. Filix-mas and L. dilatata or L. spinulosa."

It appears to be a plant of extreme rarity, as only 3 stations are known for it—namely, near the Cataract of Geroldsau, in the Grand Duchy of Baden, where it was found growing with L. spinulosa and Filix-mas by A. Braun in 1834; in the Aachener-Busch, between Aix-la-Chapelle and Altenberg, found by Braun in 1859; and at Windermere, in 1854, by Messrs. Huddart and Clowes, but it was not recognised till sent to Mr. T. Moore in 1859. In 1870 the late Mr. J. Ward sent to the Botanical Exchange Club some examples of a Fern from the Black Plantation, near Richmond, Yorkshire, July 1870. The specimens were named by Mr. Ward 'L. dilatata, var.' Mr. H. C. Watson named them 'spinulosa.' I was inclined to refer them to Filix-mas, var. incisa. The specimens are almost barren, and evidently malformed; but, except for the shorter and broader fronds (1½ to 2 feet by 5 to 8 inches), less acute teeth, and the shorter stipes, they agree best with L. remota. It is to be hoped that some botanist will examine the locality.

Remote Shield-fern.

SPECIES VI.—LASTREA CRISTATA. *Presl.*

PLATE 1853.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 17.
L. cristatum (type) *T. Moore*, Phyt. 1851, p. 149, and Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 209. *Bab.* Man. Brit. Bot. ed. vii. p. 447.
L. cristatum α. Callipteris, *Hook. & Arn.* Brit. Fl. ed. viii. p. 585.
L. Callipteris, *Newm.* Hist. Brit. Ferns, ed. ii. p. 12.
Nephrodium cristatum, *Mich.* (type). *Hook. fil.* Stud. Fl. p. 465. *Hooker & Baker*, Syn. Fil. ed. ii. p. 273.
Aspidium cristatum, *Swartz. Smith*, Eng. Bot. No. 2125; and Eng. Flora, Vol. IV. p. 289. *Fries*, Summ. Veg. Scand. p. 82. *Rabenh.* l. c. No. 17.
A. cristatum (type), *Milde*, Fil. Europ. p. 129.
Polystichum cristatum, *Roth. Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 978. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 631.
P. Callipteris, *DC.* Fl. Fr. ed. iii. Vol. II. p. 562.
Polypodium cristatum, *Linn.* Sp. Plant. p. 1551.
P. Callipteris, *Ehrhart*, Beitr. zur Naturk. Vol. III. p. 77, non 'Wilms.' (*Milde*).
Lophodium Callipteris, *Newman*, Phyt. 1851, App. p. xix.; and Hist. Brit. Ferns, ed. iii. p. 170.

Caudex elongate, rather thick, separating into numerous small divisions which are moderately thick, elongate, and creeping, except where the plant grows in dry ground (when the crowns are closely packed together), partially covered by the more or less separated bases of former fronds. Fronds of 2 kinds, a few produced close together from the extremity of each division or crown, deciduous, sub-evergreen. Fertile fronds quite erect. Stipes rather long (from one-third as long to as long as the lamina), stout, deeply channelled on the anterior face, containing 5 vascular bundles, without glands, more or less sparsely clothed with broadly-ovate cuspidate concave entire very pale brown subpersistent scales. Lamina firm, rather pale yellowish-green, glabrous and without glands, strapshaped, abruptly acuminate at the apex, very abrupt at the base, pinnate; lowest pair of pinnæ deltoid or deltoid-triangular, about the same length and form as 3 or 4 of the succeeding pairs, but shorter than those in the middle of the frond, which are triangular, all of them shortly stalked, pinnatipartite, or the lower ones almost pinnate towards the base; pinnules or ultimate segments oblong, attached by the whole breadth of their base, decurrent on the lower side, the lowest pair on each pinna alone partially separated on both sides from the wing of the partial rachis to which the segments are attached, more or less serrate or doubly serrate; those nearest the rachis sometimes lobed or almost pinnatifid; teeth incurved upwards, acute, or some of them mucronate. Ultimate veins slightly impressed on the upper surface, running from the midrib to the margin of the segments, clavate, forked or alternately branched, according to the size of the lobe; some at least of the venules running into teeth. Sori confined to the pinnæ of the upper half of the frond, attached to the back of the anterior branch of the ultimate veins, forming a line on each side of the mid-vein of the segment of the pinna nearly equidistant from it and the margin of the pinnule or segment and extending nearly to the apex of the pinnules, sometimes also at the base of the pinnule on 2 or more branches of the vein. Indusium thin, soon shrivelling, subpersistent, roundish-reniform, flat, slightly erose, but without glands either on the margin or surface. Spores tuberculate, with large sparse rounded tubercles. Barren fronds numerous, arching greatly backwards, much shorter than the fertile fronds, and with a short, slender stipes. Lamina oblong or elliptical-oblong, tapering gradually from $\frac{2}{3}$ of the frond to the apex, thinner in texture than that of the fertile frond, pinnate; pinnæ approximate, pinnatipartite; ultimate segment broadly oblong, closely approximate, rounded or obtuse at the apex, evenly toothed and with the teeth shorter than in the fertile frond, and not mucronate.

In bogs and on wet heaths, especially among Alder bushes. Very local. At Tritton Decoy, near the old decoy at Mestleton, and Bexley Decoy, near Ipswich, Suffolk; Edgefield Heath, near Holt (Mr. Wingham); Lurlingham Broad (Rev. W. S. Hoare); Lezeak, (Rev. John Freeman); Higham Sounds, near Burnley Hall (A. O. Black); Holt Lows (Rev. W. H. Girdlestone); Derlingham and Bawsey Heath, near Lynn; Fakenham and Wymondham, Norfolk; Huntingdonshire (Rev. M. J. Berkeley); Madeley bog, near Newcastle-under-Lyme, Staffordshire; Oxton bogs, Nottingham; Achmere, Delamere Forest (J. F. Robinson); Wybunbury bog, Cheshire; Malton, Yorkshire, "Messrs. Monkman and J. Mackle" (Lowe). Reported also from Bedford and Worcestershire. In Scotland the only known station is in a bog beyond Crofthead, near Neilston, Renfrewshire, 12 miles south-west of Glasgow.

England, Scotland. Perennial. Autumn.

Caudex slowly creeping, sometimes 2 feet long, about as thick as a man's thumb or more, the branches terminated by crowns, which advance each year; but when growing in dry soil the plant becomes tufted, as the divisions of the caudex do not elongate, but remain closely packed together, forming a many-headed caudex. Fertile fronds 18 inches to 3 feet high, of which the lamina is 9 to 18 inches, and 3 to 5 inches broad, very stiffly erect, with the pinnæ rather distant, 5 or more of the lower pairs broader shorter and more spreading than the succeeding ones; all of them slightly twisted, so that their upper surface makes an angle with the general plane of the frond; in vernation they are flat, and applied to the rachis. Barren fronds 6 to 18 inches long by 3 to 6 inches broad, the pinnæ decreasing from the middle towards both base and apex, closer together, less acute than in the fertile fronds, and with the segments contiguous. Stipes slender, 3 to 6 inches long. Rachis of both barren and fertile fronds usually bare of scales.

I am indebted to Dr. J. Fraser for specimens of the barren fronds from Wybunbury bog; and also to Mr. J. F. Robinson, from Achmere. These fronds appear to be rare in herbaria, botanists satisfying themselves with collecting the fertile ones. I have never seen them deficient in the cultivated plant; and though when weak it produces nothing else, yet as they are present whenever it is growing vigorously, they may be considered as a normal feature of its growth.

This plant cannot well be confounded with any British Fern, except L. uliginosa. The differences will be mentioned hereafter. Strangely enough, L. Filix-mas was figured in the original edition of 'English Botany,' No. 1949, for it. Smith says Mr. Sowerby was deceived by a wrong specimen sent from the Isle of Wight, but that Filix-mas was never mistaken for cristata by him. I have long had the plant in cultivation from Edgefield and Bawsey Heath, sent me by the Rev. Kirby Trimmer; it is much less vigorous than L. uliginosa and spinulosa growing beside it.

Crested Shield-fern.

SPECIES VII.—**LASTREA ULIGINOSA.** *Newman.*

PLATE 1854.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 19. *Newm.* Phyt. 1849, p. 678.

L. cristata, var. β. uliginosa, *Moore*, Phyt. 1851, p. 149; and Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 210. *Bab.* Man. Brit. Bot. ed. vii. p. 447. *Hook. & Arn.* Brit. Fl. ed. viii. p. 585.

Nephrodium cristatum, β. uliginosum, *Hook. fil.* Stud. Fl. p. 465. *Hook. & Bak.* Syn. Fil. ed. ii. p. 273.

Aspidium cristatum, var. uliginosum, *Milde*, Fil. Europ. p. 130.

A. spinulosum × cristatum, *Milde*, Verhandl. der Schles. Gesellsch. 1855, p. 64; and Nov. Act. 1858, p. 532. *Lasch.* in Bot. Zeit. 1856, p. 435, teste *Milde*. *Rabenh.* l. c. No. 19.

Lophodium uliginosum, *Newm.* Phyt. 1851, p. 371; and App. XIX. Hist. Brit. Ferns, ed. iii. p. 163.

Caudex short (or elongate when growing in bogs?), rather thick, separating into numerous rather small divisions or crowns, which are moderately thick, short, and closely packed together (probably more elongate and creeping when growing in moist bogs?), covered by the imbricated bases of former fronds. Fronds of two kinds, several produced close together round the extremity of each division or crown, deciduous. Fertile fronds stiffly erect. Stipes rather long ($\frac{1}{6}$ to nearly $\frac{1}{2}$ the length of the lamina), stout, deeply channelled on the anterior face, containing 5 vascular bundles, without glands, more or less sparsely clothed with broadly-ovate cuspidate concave entire very pale brown subpersistent scales. Lamina firm, deep yellowish-green, glabrous and without glands, strapshaped, tapering gradually to the apex, abrupt at the base, pinnate; lowest pair of pinnæ deltoid-triangular, with the basal pinnules nearly equally long both above and below, about as long as the succeeding pair, the others becoming gradually longer and narrower till about the middle of the lamina where they are narrowly triangular, after which they gradually diminish in length to the apex; all of them shortly stalked, pinnate; pinnules flat, elliptical-oblong, or those next the rachis oblong-triangular, attached by only a portion of their base, decurrent on the lower side; the lowest pair on each pinna quite separated and almost stalked, deeply pinnatifid or pinnatipartite with the lobes inciso-serrate; the pinnules towards the apex of the pinnæ less deeply pinnatifid, and those towards the apex simply inciso-serrate; teeth incurved, acute, most of them mucronate. Ultimate veins deeply impressed on the upper surface, running from the midrib of the segments of the pinnules to their margins, clavate, all except the anterior one (which runs into the notch between the teeth), running into the teeth. Sori usually occupying the whole frond, attached to the back of the anterior branch of the ultimate veins, forming a line on each side of the ultimate segment of the pinnule in the lower pinnules, and of the pinnule or segment itself towards the apex of the pinnæ, about midway between the mid-vein and the margin of the segment or pinnule, as the case may be, and extending nearly to the apex. Indusium thin, soon shrivelling, subpersistent, roundish-reniform, flat, slightly erose, but without glands either on the margin or surface. Spores abortive in all the specimens I have examined. Barren fronds numerous, arching backwards, much shorter than the fertile ones, and with a short, slender stipes. Lamina oblong, tapering gradually from the middle of the frond to the apex, thinner in texture than those of the fertile fronds, pinnate; pinnæ approximate, pinnatipartite; ultimate segments oblong, closely approximate, obtuse at the apex, doubly serrate, with the teeth incurved, short and scarcely mucronate.

In bogs, growing in company with L. cristata and L. spinulosa, very local. Bawsey Heath, Norfolk; Wybunbury bogs, Cheshire; Oxton bogs, Nottingham (Newman); Malton, Yorkshire (Monkman). Reported from Epping Forest, Essex; Castle Howard, Yorkshire, and Derwentwater, where L. cristata does not grow, but I doubt it being the true plant.

England. Perennial. Autumn.

Rootstock in the cultivated plant breaking into numerous crowns, which remain closely packed together; they attain a larger size than those of L. cristata before they break, having often 6 or 8 fronds growing from a single one. No botanist seems to have published any results of examination of the caudex of this Fern in its native localities, but it is very probable that the branches of the caudex, when it is growing in boggy soil, creep like those of L. cristata and spinulosa, both of which assume a tufted condition when grown in ordinary garden soil; but L. uliginosa certainly forms larger crowns than either of the others when cultivated under precisely similar circumstances. Fertile fronds 18 inches to 3 feet high, and 4 or 5 inches broad; pinnæ rather distant, the lower ones spreading, the uppermost ones ascending, all somewhat twisted round so as to turn their upper surface to the sky. Barren fronds 8 to 12 inches long, by 2½ to 4 inches broad.

Occasionally late in the year fertile fronds shorter and less divided than the ordinary ones, and consequently much more resembling those of L. cristata than the ordinary ones, are produced; but, as far as my experience goes, this is by no means a usual occurrence. It seems as if sori were produced on what ought to have been barren fronds.

A very puzzling plant, quite intermediate between L. cristata and L. spinulosa. It differs from the former in its longer, narrower, and more acute pinnæ and more separated pinnules or ultimate segments, many of those next the rachis being pinnatifid, and with their lobes, as well as the margins of the segments towards the apex of the pinnæ, much more deeply toothed, and the teeth more decidedly mucronate. The basal pinnules, from being more divided, instead of giving off veins from the midrib of the pinnule which run to the margin, give off flexuous veins, running into each lobe, and from this flexuous vein are given off ultimate veins, of which all but the first anterior branch run into the teeth, and terminate in a clavate apex before reaching the point of the tooth. All the veins are much more deeply impressed on the upper surface than those of L. cristata, consequently the surface of the frond is less smooth; in fact, but for its rigid uprightness and more spreading pinnæ, it closely resembles the less divided and narrower states of L. spinulosa. I have never found mature spores in the sporangia of my cultivated plants, but that arises, no doubt, from their growing in too dry ground.

The barren fronds are much more like those of cristata than the fertile ones, indeed it would be scarcely possible to separate them if mixed up among each other; usually, however, those of L. uliginosa are broader, with the pinnæ more acute, the ultimate segments more nearly divided from each other, and more distinctly serrated. They are darker in colour and less smooth on the surface.

I have very little doubt of L. uliginosa being a hybrid between L. cristata and L. spinulosa. It appears to be found in company with them, but is certainly less abundant than L. cristata, and much less so than L. spinulosa: now if it were an intermediate state connecting these two we should expect to find it, if not more abundant than either, more plentiful than one of them. If it really be an intermediate form I think Mr. T. Moore's view is the only one tenable, viz., that we must consider L. cristata, L. uliginosa, and L. spinulosa as one species. In the 'Phytologist' for 1852, p. 694, Mr. Newman states that "he had possessed for at least 6 years a plant of that form of Lastrea usually known as cristata, but to which he wished to restrict the name Callipteris, by Ehrhardt. This plant originally came from Bawsey, and was most rigidly typical of its kind; cultivated in a dry London atmosphere, it had strictly retained its original characters, except that, getting weaker year after year, it has grown small by degrees and beautifully less. The weather at last proved too dry, and this individual plant was planted in bog earth, abundantly supplied with water and placed in a close greenhouse, where the thermometer frequently rose above 90° Fahrenheit. Its growth became vigorous in the extreme, but this was not all. Frond after frond appeared, each receding more than the last from the typical figure of Callipteris, and approaching that of uliginosa, and at the present moment it has fronds evidently from the same cormus, which would serve admirably as representatives of both supposed species." I have tried treating L. cristata in this way for six years, but it has retained its typical form. Mr. Newman says that in spring it is 20 days later than multiflora (dilatata) in expanding, 10 days later than L. spinulosa, and from 10 to 15 days earlier than Callipteris (cristata), which accords pretty well with my own experience, except that I find 10 instead of 20 days the difference between dilatata and spinulosa; but Mr. Moore has never found any constancy in this respect with cultivated plants. The fronds of L. uliginosa last till December in ordinary years.

Milde quotes Aspidium Boottii, Tuckerman (A. spinulosum var. Boottii, Gray, Man. Bot. U. S.) as a synonym of L. uliginosa, and I have characteristic specimens of it from Christiania, sent by the late Professor Blyth, under the name "Polystichum spinulosum, var. fere P. Boottii, Americanorum," but in Gray's Manual the involucre of Boottii is said to be glandular, and the plant to be closely allied to the European form A. remotum, Braun, while in Hook. and Bak. Syn. Fil. it is referred to L. spinulosum, and L. collina, Newman, is given as a synonym of var. *Boottii*. I have no specimens of it, and therefore I have not ventured to quote the American name.

Lloyd's Shield-fern.

SPECIES VIII.—**LASTREA SPINULOSA.** *Presl.*

PLATE 1855.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 18.
L. spinosa, *Newm.* Nat. Hist. Brit. Ferns, ed. ii. p. 209.
L. cristata, var. spinulosa, *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 210.
Nephrodium spinulosum, "*Desv.*" *Hook. fil.* Stud. Fl. p. 466.
N. spinulosum, *a*, *Hook. & Bak.* Syn. Fil. ed. ii. p. 275.

Aspidium spinulosum, *Swartz.* *Sm.* Eng. Bot. No. 1460; and Eng. Fl. Vol. IV. p. 292 (?) *Milde*, Fil. Europ. p. 132.

A. spinulosum, var. *a*, *Fries*, Summ. Veg. Scand. p. 82.

A. cristatum, var. spinulosum, *Hook.* & *Arn.* Brit. Fl. ed. viii. p. 885.

Polystichum spinulosum, *a.* vulgare, *Koch*, Syn. "Fl. Germ. et Helv. ed. ii. p. 979." *Gren.* & *Godr.* Fl. de France, Vol. III. p. 632.

P. spinosum, *Roth*, Fl. Germ. Vol. III. p. 91, teste *Newm.*

Polypodium spinulosum, *Muller*, "Fl. Fridrichsdal, 193, No. 841, t. ii. f. 2," teste *Moore.*

Lophodium spinosum, *Newm.* Phyt. 1851, p. 371, and App. XVIII.; and Hist. Brit. Ferns, ed. iii. p. 157.

Caudex short or elongate, rather thick, separating into numerous small divisions, which are moderately thick, more or less elongate and creeping, but sometimes (when growing in dry ground short and with the crowns closely packed together), partially covered by the more or less separated bases of former fronds. Fronds all similar, a few produced from the extremity of each division or crown, sub-evergreen, erect, or more rarely inclining backwards. Stipes long (from one-third to quite the length of the lamina), rather stout, deeply channelled on the anterior face, containing 5 vascular bundles, usually without glands, rather sparsely clothed with ovate cuspidate concave entire very pale brown subpersistent scales, sometimes intermixed with lanceolate ones. Lamina firm, yellowish-green or deep green, glabrous and usually without glands, strapshaped or oblong-strapshaped or lanceolate-oblong, tapering gradually towards the apex, abrupt at the base, bipinnate or almost tripinnate; lowest pair of pinnæ unequally triangular or deltoid-triangular, with the basal pinnules longer on the lower than on the upper side of the midrib, about as long as the succeeding pair of pinnæ, the others becoming gradually longer and narrower as far as a little below the middle of the lamina, where they are narrowly triangular, after which they gradually diminish in length; all of them shortly stalked, pinnate; pinnules flat or convex, elliptical oblong, or the lower ones oblong-triangular, attached by a very small portion of the centre of their base, the basal ones of the lower pinnæ not decurrent and frequently shortly stalked, usually only those towards the apices of the upper pinnæ decurrent; lower ones pinnatipartite or deeply pinnatifid, with the lobes inciso-serrate, those pinnules towards the apex of the pinnæ less deeply pinnatifid, and those at the apex only inciso-serrate; teeth scarcely incurved, strongly mucronate. Ultimate veins deeply impressed on the upper surface, all except the anterior one (which runs into the notch between the lobes) running into the teeth. Sori usually occupying the whole frond, except the lowest pair of pinnæ, but sometimes confined to its upper half, attached to the back of the anterior branch of the ultimate veins, forming a line on each side of the midrib of the ultimate segment of the pinnule nearer the midrib than the margin of the pinnule or segment as the case may be, and extending nearly to its apex. Indusium thin, soon shrivelling, subpersistent, roundish-reniform, flat, entire or remotely denticulate, but without glands either on the margin or surface. Spores tuberculate, with sparse large rounded tubercles. No barren fronds unlike the fertile ones.

Var. α. *elevatum.*

Aspidium spinulosum, var. elevatum, *A. Braun.* *Milde*, **Fil. Europ. p. 133.**

Rachis without glands. Lamina firm, yellowish-green, without glands, strapshaped or oblong-strapshaped, nearly parallel-sided. Indusium nearly entire, without glands on the margin.

Var. β. *exaltatum.*

Aspidium spinulosum, var. exaltatum, *Lasch.* *Milde*, **Fil. Europ. p. 132.**

Rachis without glands. Lamina thin, deep green without glands, oblong-lanceolate or ovate-lanceolate, more or less curved-sided. Indusium nearly entire, without glands on the margin.

Var. γ. *decipiens.*

Rachis sprinkled with minute stalked glands. Lamina firm, yellowish-green, with minute clavate glands beneath, oblong-strapshaped or lanceolate-oblong. Indusium dentate, with the teeth usually without glands.

Var. α in bogs and on heaths. Var. β in woods. Both forms rather common, and generally distributed in England. More rare in Scotland, and certainly occurring as far north as Aberdeen, Perth and Inverness, and recorded as far north as Elgin, Ross and the Isle of Lewis. Sparingly distributed throughout Ireland from south to north. Var. γ, wood below Linley, near Broseley, Salop, Mr. G. Moore (*sub nom.* "L. dilatata β. glandulosa"); roadside between Inver Cloy and Brodick Castle, Arran. Perhaps some of the forms referred to L. glandulosa, which are said to have creeping caudices, belong to this variety of spinulosa, though Mr. F. Clowes distinguishes 'glandulose spinulosa' from 'glandulosa' at Windermere.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex slowly creeping when growing in boggy soil or leaf-mould, in which case the divisions extend and separate the crowns from each other, but when the plant grows in dry soil the divisions do not elongate and the crowns remain close together, so that the plant has a number of small tufts. Fronds 9 inches to 3 feet high or more, of which the stipes is usually about half, but sometimes less, and sometimes a little more. Var. α has the lamina firm, nearly parallel-sided, 6 inches long by 2¼ inches broad to 18 inches long by 5 broad, yellowish-green, with the pinnæ pointing upwards; in this state it closely resembles the fertile fronds of L. uliginosa, but the frond is more divided; the basal pinnæ have most of their pinnules separated, and the two pinnules at the bottom of the pinnæ on the lower side of the pinnules are much longer than on the upper side, and though this occasionally happens in L. uliginosa it is to a far less extent. The pinnæ are longer, and form a more acute angle with the rachis, they are not so much twisted out of the plane of the lamina, so that their upper surface is not so horizontal. Var. β attains a considerably larger size, and is broader and less parallel-sided, being from a foot long by 5 inches broad to 2 feet long by 11 inches broad; the frond is much thinner and of a deeper green, and the lower pinnules are often again pinnate. The sori are smaller than in var. α, and do not become confluent as they often do in it. Var. γ appears to be a form which Milde refers to under var. elevatum. "Hujus varietatis formam eximiam in montibus Moraviæ observavi. Pagina subtus glandulosa; glandulæ longæ, clavatæ, unicellulares; dentes laciniarum longissimi, in glandulam exeuntes. Indusium glabrum. Raches dense paleaceæ; petiolus dense rufo-paleaceus, brevior (5–8″ longus). Ceterum lamina angusta, rigida, flavescens."—*Fil. Europ.* p. 133. This agrees well with my var. γ.

The creeping caudex with its numerous small divisions, or when in dry ground the caudex dividing into numerous small heads, and the more parallel-sided frond distinguish it from L. glandulosa.

The broad concolorous scales, many-headed caudex, and narrower fronds, separate it from L. dilatata.

The spores are similar to those of L. spinulosa, with a few large, rounded tubercles, not closely and finely muricated as in L. glandulosa and dilatata.

Vars. α and β look very different when growing wild, but when brought into the garden they lose most of their peculiarities, and it is probable that instead of being true varieties they are states affected by their place of growth.

I have genuine L. spinulosa from Amherstburg, Canada, collected by Dr. P. W. Maclagan.

Lastrea remota is referred by some botanists to L. spinulosa, but it differs in the far more numerous scales, many of them narrowly lanceolate, by the greater number of pinnæ in fronds of equal size, by the veins being less impressed above, but chiefly by the indusium being firm and very convex, and retaining its shape like that of L. Filix-mas instead of being thin, flat, and soon crumpled up when the spore-cases swell and raise its edges. Still there can be no doubt that it is a form connecting L. spinulosa and L. Filix-mas.

Narrow Shield-fern.

SPECIES (?) IX.—**LASTREA GLANDULOSA.** *Newman.*

PLATE 1856.

Newman, Phyt. 1851, p. 256.

L. dilatata, var. glandulosa, *Moore* (in part ?), Handbk. Brit. Ferns, ed. ii. p. 124; and ed. iii. p. 127; Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 226 (in part). *Bab.* Man. Brit. Bot. ed. vii. p. 448.

Nephrodium dilatatum, var. glandulosum, *Hook. fil.* Stud. Fl. p. 466.

Lophodium glandulosum, *Newm.* Phyt. 1851, Ap. xviii. and Hist. Brit. Ferns, ed iii. p. 154.

L. glanduliferum, *Newm.* Phyt. 1851, p. 371 (a misprint for glandulosum ?)

Caudex short, very thick, separating into few divisions or crowns, which are very thick and erect or "creeping." Fronds all similar, many produced from the extremity of each division or crown, sub-evergreen, "semi-erect" (Newman). Stipes long (two-thirds to as long as the lamina), stout, deeply channelled on the anterior face, containing 5 vascular bundles, thickly sprinkled with minute clavate or stalked glands and rather thickly clothed with broadly-ovate cuspidate and lanceolate tapering entire pale brown nearly concolorous sub-persistent scales. Lamina firm, dull green, sprinkled beneath with very numerous clavate glands, narrowly oblong or lanceolate-oblong, tapering more or less gradually towards the apex, abrupt at the base, bipinnate or almost tripinnate; lowest pair of pinnæ unequally triangular with the 2 basal pinnules on the lower side of the secondary rachis much longer than those on the upper side, nearly as long as the succeeding pair of pinnæ; the others becoming gradually longer and narrower as far as a little below the middle of the lamina, after which they at first gradually and then rapidly decrease in length; all of them shortly stalked, pinnate; pinnules "flat or convex," lanceolate-oblong; those towards the base of the lamina shortly stalked and pinnatipartite, or sometimes almost pinnate; those towards the apex of the frond decurrent at the base; ultimate segments adnate by a broad base and decurrent on the lower side, oblong inciso-serrate, with the teeth hooked upwards and strongly mucronate. Ultimate veins rather faintly impressed on the upper surface, running to the teeth of the ultimate segments, except the first anterior branch. Sori occupying the whole frond, except sometimes the lowest pair of pinnæ, attached to the back of the first anterior branch of the ultimate mid-veins forming a line on each side of the ultimate pinnules or ultimate segments, about equidistant from the midrib and the margin of the pinnule or segment, and extending nearly to its apex. Indusium rather thin, but retaining its form, subpersistent, roundish-reniform, slightly convex, with a few clavate or stalked glands round the margin, and sometimes a few on its surface. Spores finely muricate, with very numerous small acute tubercles. No barren fronds unlike the fertile ones.

Darley Dingle, Shropshire; boggy places on Ankerberry Hill, near Sedbrook, Forest of Dean, Gloucester; and "Epping Forest, Essex" (Mr. Doubleday; Newman). L. glandulosa has been reported from several other stations, but I do not feel sure that these are the same as plant so-called by Mr. Newman.

England. Perennial. Summer, Autumn.

Lamina 14 inches by 7 inches to 2 feet by 8 inches, remarkable for the number of minute glands sprinkled on its lower surface.

L. glandulosa is a very puzzling form, being intermediate between L. spinulosa and L. dilatata, and to some extent between L. remota and L. dilatata. The caudex I have never seen, but from Mr. Newman's description and from the recollections of the Rev. W. H. Purchas I conclude it must resemble those of L. remota and L. dilatata, in not breaking into a number of small crowns, and in the divisions keeping an upright position and attaining a large size, with very numerous fronds arranged shuttlecock-fashion. But if a plant found at Windermere, Westmoreland, by Mr. F. Clowes, really belong to L. glandulosa and not to L. spinulosa, it has a caudex "nearly, if not quite, as creeping as that of spinulosa" ('Phyt.,' ser. ii. 1860, p. 229). The scales are intermediate in character between L. remota, L. spinulosa, and L. dilatata, most like those of the first, perhaps, but more highly coloured, and not denticulate at the margins; the larger ones resemble those of spinulosa, but have generally a more decided dark shade in the centre, though less so than those of dilatata, and they are also thinner in texture than those of the last-named plant. The lamina is most like that of L. spinulosa in outline and in the shape of the pinnules, but the pinnæ are longer and narrower, and the teeth more incurved, and (judging from dried specimens) the veins are but very faintly impressed on the upper surface: still, were it not for the stout caudex, which does not break into numerous crowns, the narrower and often darker-centred scales, and, above all, the finely muricated (not coarsely and sparsely tubercled) spores, —the plant might be considered a broad-fronded and extremely glandular form of L. spinulosa. Most authors place it as a variety of L. dilatata, with which at least Mr. Newman's original plant seems to agree in the caudex, and certainly does completely in the finely muricated spores and gland-fringed indusium. But the lamina is narrower and less divided, the pinnules having their segments connected quite as much, or even more so than, in spinulosa.

From L. remota it differs in having a much shorter frond in proportion to its width, and with fewer and broader pinnæ, with distinctly mucronate teeth. The lowest pinnæ of L. remota do not present such a broadly and obliquely triangular outline, as remota has not the first and second, or even the third pinnule on the lower side of the pinna much larger than those on the upper side. The indusium of L. remota is also firmer and more convex than that of L. glandulosa, and the spores are bluntly tubercled, not finely muricated.

I cannot help suspecting that L. glandulosa is a hybrid between L. spinulosa and L. dilatata. Were it as abundant as either of the two, instead of being very scarce we might consider it as a form from which L. spinulosa on one side, and L. dilatata on the other, were diverging; and the same might be said of L. uliginosa, from which L. cristata diverges in one direction and spinulosa in the other; and lastly, we have L. remota, which connects L. spinulosa, or (as seems to me more probable) dilatata with L. Filix-mas. Surely it would be difficult to accept an aggregate species containing Filix-mas and dilatata. Dr. Göppert, in Cohn's 'Kryptogamen Flora von Schlesien,' makes dilatatum, spinulosum, and cristatum subspecies of Aspidium spinulosum, but he makes Filix-mas with this form A. remotum a distinct species, which seems to me an untenable position.

Bennett's Shield-fern.

SPECIES X.—**LASTREA DILATATA.** *Presl.*

PLATE 1857.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 40.
L. multiflora, *Newm.* Hist. Brit. Ferns, ed. ii. p. 216.
Nephrodium dilatatum, *Desv.* *Hook. fil.* Stud. Fl. p. 466.
N. spinulosum, β. dilatatum, *Hook.* & *Bak.* Syn. Fil. ed. ii. p. 275.
Aspidium dilatatum, *Swartz.* *Sm.* Eng. Bot. No. 1461; and Eng. Fl. Vol. IV. p. 293. *Milde*, Fil. Europ. p. 136. *Rabenh.* l. c. No. 40.
A. spinulosum, α. multiflorum, *Hook.* & *Arn.* Brit. Fl. ed. viii. p. 586.
A. spinulosum, var. dilatatum, *Fries*, Summ. Veg. Scand. p. 82.
Polystichum spinulosum, β. dilatatum, *Koch*. Syn. Fl. Germ. et Helv. ed. ii. p. 979. *Gren.* & *Godr.* Fl. de Fr. Vol. III.
P. multiflorum, *Roth*, Fl. Germ. Vol. III. p. 87.
Polypodium multiflorum, *Roth*, Cat. Bot. Fasc. i. p. 35.
Lophodium multiflorum, *Newm.* Phyt. 1851. p. 371, and App. xvii.; and Hist. Brit. Ferns, ed. iii. p. 148.

Caudex short, very thick, separating into few divisions which are very thick and erect or ascending, closely covered by the persistent bases of former fronds, without dark stripes in their interior when cut longitudinally. Fronds all similar, many produced from the extremity of each division or crown, ascending or erect, and arching backwards, sub-evergreen. Stipes long (one-third as long to as long as the lamina), stout, deeply channelled on the anterior face, containing 5 or 7 vascular bundles, usually more or less thickly sprinkled with minute stalked glands, but often glabrous and without glands, rather thickly clothed with lanceolate and strapshaped tapering entire or subdenticulate brown scales, which have almost always a dark central stripe, and are mostly persistent. Lamina firm or subcoriaceous, dull green, usually sprinkled beneath with more or less numerous clavate glands, but sometimes without glands, oblong-lanceolate or oblong-ovate or ovate-lanceolate, rarely triangular-ovate or triangular-lanceolate (at least in mature and healthy plants), tapering gradually towards the apex, abrupt or truncate at the base, tripinnate or quadripinnate, rarely only bipinnate; lowest pair of pinnæ unequally triangular, with the 2 basal pinnules on the lower side of the secondary rachis much longer than those on the upper side, nearly as long as the succeeding pair of pinnæ; the others usually becoming gradually longer and narrower as far as one-third of the lamina, after which they gradually decrease in length (or rarely the second pair of pinnæ or even the first are longer than the others), shortly stalked, bipinnate, more rarely tripinnate or only pinnate; pinnules convex or flat, lanceolate-oblong; those towards the base of the lamina stalked and pinnate, more rarely bipinnate, and very rarely only pinnatipartite; those towards the apex of the frond usually separate from each other and pinnatipartite or inciso-pinnatifid; most of them adnate by a narrow base, but decurrent upon the lower side; ultimate pinnules or ultimate lobes flat or with the margins recurved, inciso-serrate, with the teeth strongly incurved and very strongly mucronate. Ultimate veins rather faintly impressed on the upper surface, all running to the teeth of the ultimate segments except the first anterior branch. Sori occupying the whole frond, attached to the back of the first anterior branch of the ultimate mid-veins, forming a line on each side of the ultimate pinnules or ultimate segments about equidistant from the mid-vein and the margin of the pinnule or segment, and extending nearly to its apex. Indusium thin, soon shrivelling, subpersistent, roundish-reniform, nearly flat or slightly convex, with a few clavate or stalked glands round the margin. Spores finely muricate, with very numerous small acute tubercles. No barren fronds unlike the fertile ones.

Var. α. *genuina.*

Rachis and under side of lamina sparingly glandular or nearly without glands; scales brown with a dark central stripe or blotch. Lamina firm, lanceolate-ovate or oblong-ovate, tripinnate or bipinnate, with the pinnules pinnatipartite; lowest pinnæ unequal-sided from the greater development of the 1st and 2nd pinnules on the lower side of the secondary rachis. Sori large.

Var. β. *tanacetifolia.* Moore.

Polystichum tanacetifolium, *DC.* Fl. Fr. Vol. II. p. 562; according to a specimen from Professor Fée, *Moore.*

Rachis and under side of lamina sparingly glandular or nearly without glands (rarely very glandular); scales lanceolate, brown with a dark central stripe or blotch. Lamina rather thin, triangular-ovate or ovate, tripinnate or almost quadripinnate, with the ultimate pinnules pinnatipartite; lowest pinnæ unequal-sided from the great development of the 1st and 2nd pinnules on the lower side of the secondary rachis. Sori small.

Var. γ. *dumetorum.* Moore.

Lastrea multiflora, var. nana, *Newm.* Hist. Brit. Ferns, ed. ii. p. 222.
Aspidium dumetorum, *Sm.* Eng. Fl. Vol. IV. p. 281 (*vide H. C. Watson*, Compend. Cyb. Brit. Part. III. p. 456).
Lophodium nanum, *Newm.* Hist. Brit. Ferns, ed. iii. p. 153.

Rachis and under side of lamina sparingly glandular, or nearly without glands; scales brown with a dark central stripe or blotch. Lamina firm, oblong-ovate, bipinnate, with the pinnules pinnatipartite; lowest pinnæ somewhat unequal-sided from the rather greater development of the 1st and 2nd pinnules on the lower side of the secondary rachis. Sori small.

Var. δ. *collina.* Bab.

Lophodium collinum, *Newm.* Phyt. 1851, App. xviii.; and Hist. Brit. Ferns, ed. iii. p. 144.

Rachis and under side of lamina thickly sprinkled with stalked glands; scales brown, with a dark central stripe or blotch. Lamina firm, strapshaped-lanceolate or triangular-lanceolate, bipinnate with the pinnules pinnatipartite; lowest pinnæ somewhat unequal-sided from the rather greater development of the 1st and 2nd pinnules on the lower side of the secondary rachis; pinnæ more distant and narrower than in the preceding forms. Sori rather small.

Var. ε. *alpina.* Moore.

Rachis and under side of lamina sparingly glandular or nearly without glands; scales ovate-lanceolate, reddish-brown, often without a dark central stripe. Lamina thin, oblong or oblong-strapshaped, more rarely ovate-oblong, tripinnate or bipinnate, with the pinnules pinnatipartite; lowest pinnæ unequal-sided from the great development of the 1st and 2nd pinnules on the lower side of the secondary rachis; pinnules shorter in proportion than in the other forms. Sori rather large.

(?) Var. ζ. *lepidota.* Moore.

Rachis and under side of lamina rather sparingly sprinkled with stalked glands; scales broadly lanceolate, intermixed with ovate cuspidate ones, dark reddish-brown, nearly concolorous, numerous not only on the stipes and main rachis, but also on the secondary and tertiary rachides. Lamina deltoid or broadly triangular-ovate, quadripinnate or tripinnate with the lower pinnules pinnatipartite; lowest pinnæ unequal-sided, from the much greater development of the 1st and 2nd pinnules on the lower side of the secondary rachis; pinnules more separated from each other, as well as more deeply divided than in the other forms. Sori small.

Var. α common, and generally distributed in hedgebanks, woods and moors, and hillsides.

Var. β common in shady woods.

Var. γ common in upland districts, on moors, and among rocks and stony places.

Var. δ. *collina* appears to be local. Newman says it occurs in the lake district in Westmoreland, Lancashire and Yorkshire. I have a specimen collected by Mr. Baker on the top of Little Ingleborough, and what I believe to be the same form I gathered at Hobbister rocks, Orphir, Orkney. Mr. Moore's figure of his variety L. Chanteriæ, given in his 'Handbook of British Ferns,' so closely resembles Mr. Newman's figure of collina in his 'Hist. Brit. Ferns,' that I must refer them to the same form; the Rev. Mr. Chanter's plant was found at Hartland, on the north coast of Devon.

Var. ε. *alpina* is frequent on mountains and on upland bogs.

Var. ζ. *lepidota* is not known in the wild state; it was said to have been procured from Yorkshire.

England, Scotland, Ireland. Perennial. Summer, Autumn.

An extremely variable plant, though it can scarcely be divided into varieties in a botanical sense, so insensibly do the different forms merge into one another; whether we place the forms under two or twenty varieties makes very little difference, with the exception of the form *lepidota*, which is a doubtful native, and is certainly distinct enough to be called a true variety, if not a subspecies. The rootstock is remarkable for not breaking, *i.e.*, it continues to grow until it has attained a large size before it divides and forms new crowns, in this forming a marked contrast to that of L. spinulosa. The divisions of the caudex in the large wood forms of the plant are often as thick as a man's arm, and are generally erect; but sometimes the branches of the caudex when growing amongst dead leaves or bushes, or even in bogs, become as slender and creeping as those of L. spinulosa, but they differ in not constantly forming new crowns before they have attained a large size. I suspect that this may account for the statements of forms of L. dilatata "being nearly, if not quite, as creeping as spinulosa" ('Phyt.' ser. ii. 1860, p. 229).

I have numerous specimens, collected in Fife, with slender creeping offshoots, produced from large crowns of ordinary L. dilatata. The most puzzling forms are specimens of var. *alpina*, which I collected in 1875, in the parish of Orphir, Orkney, growing in Naversdale and Ryssadale. These had small crowns and often decidedly creeping branches, and in many instances the scales were broad and pale-coloured and the lamina narrow and parallel-sided. At the time I collected these, I supposed them to be referable to the glandular form of L. spinulosa, but a root which I brought to Balmuto has produced much divided triangular-deltoid fronds, which are clearly referable to L. dilatata, although the scales are still broader than those of the ordinary plant and concolorous. Usually the scales of L. dilatata are broadly lanceolate and tapering, intermixed with smaller ones, they are entire or slightly fimbriate, and have a brown or pitchy stripe down the centre, but in the forms which Mr. Moore calls *alpina* (which is probably a true variety) they are often broader and nearly concolorous.

The shape of the lamina varies greatly, but it is almost always broader than in L. spinulosa. I have fertile specimens from 5 inches long by 2½ wide, to 3 feet long by 15 inches wide, while in a very handsome form of *alpina* from Orkney the frond is 15 inches long and 5 wide, with the fronds very delicate in texture and much divided, and the scales broad, ferruginous, and nearly concolorous.

The texture of the lamina is also variable, it is generally firm, more so indeed than that of L. spinulosa when growing in the same localities, but in the form *alpina*, and to a less extent in the wood-form *tanacetifolia*, it is thin, but is never at all translucent.

In most of the forms the pinnules are more or less convex, when they are exposed to the direct rays of the sun. I have found that a flat pinnuled plant brought into a sunny part of the garden, produces fronds with convex pinnæ. As a general rule, the more luxuriant the plant the more divided is the frond.

The number of glands on the stipes, rachis, lamina and margin of the indusium is also liable to great variation, though I have never observed the indusium, at least in the young state, without some stalked or clavate glands. The fronds remain green all winter in sheltered stations, but the stipes breaks over near the base, and the fronds are prostrate. In vernation the frond occasionally forms loops, but more commonly it unfolds regularly as in other Ferns.

The marking of the spores seems very constant; instead of a few large rounded tubercles as in L. spinulosa, they are thickly covered with small conical acute tubercles.

The variety *lepidota* is probably a distinct species, though its native locality is doubtful; it is much more divided than any of our British forms, quite as much as or even more so than the North American L. intermedia (which also occurs in Madeira), and it agrees with this in the lamina having a triangular or deltoid-ovate outline (though more ovate in *lepidota* than in L. intermedia), but it differs conspicuously in the shorter broader blunter and paler scales, and in the first pair of pinnules of the basal pinnæ being longer than the second, as in all the British forms of L. spinulosa, dilatata and æmula, and also in not having the pinnæ spreading at right angles to the rachis, and the pinnules at right angles to the secondary rachides. One of the most striking peculiarities of *lepidota* is the number of broad cuspidate and narrow piliferous scales which clothe the under surface and sides of the primary, secondary, and tertiary rachides; the teeth of the segments are strongly incurved, and terminate in conspicuous mucros. Lamina 6 inches to 1 foot long, by 4 to 8 inches broad. I obtained the plant I have in cultivation from Messrs. Sang's nursery in Kirkcaldy, and have no doubt it is the same as that described by Mr. Moore.

Broad Shield-fern.

SPECIES XI.—**LASTREA ÆMULA.** *Brackenridge.*

PLATE 1858.

Rabenh. **Crypt. Vasc. Europ. Exsicc. No. 117.**

L. Fœniseeii, *Watson*, Phyt. 1846, p. 568.

L. recurva, *Newman*, Nat. Alm. 1844, p. 23; and Hist. Brit. Ferns, ed. ii. p. 226.

Nephrodium æmulum, *Baker*. *Hook. fil.* Stud. Fl. p. 466. *Hook. & Bak.* Syn. Fil. ed. ii. p. 279.

N. Fœnisecii, *Lowe*, Cambr. Phil. Trans. Vol. IV. p. 7.
Aspidium æmulum, *Swartz* (1800). *Milde*, Fil. Europ. p. 140. *Rabenh.* l. c. No. 117.
A. recurvum, *Bree*, Phyt. 1843, p. 773.
A. dilatatum, var. recurvum, *Bree*, Mag. Nat. Hist. Vol. IV. p. 162. *Hook. & Arn.* Brit. Fl. ed. viii. p. 586.
A. spinulosum, var. γ, *Hook. & Arn.* Brit. Fl. ed. vii. p. 586.
Polypodium æmulum, *Ait.* Hort. Kew. Vol. III. p. 466.
Lophodium recurvum, *Newm.* Phyt. 1851, p. 371.
L. Fœnisecii, *Newm.* Phyt. 1851, App. p. xvi.; and Hist. Brit. Ferns, ed. iii. p. 136.

Caudex short, stout, separating into numerous small divisions, which are moderately thick, very short, and closely packed together, closely covered by the imbricated bases of former fronds, marked with dark stripes in the interior when cut longitudinally. Fronds all similar, several produced close together from the extremity of each crown, ascending or slightly arching backward, evergreen. Stipes rather long, from one-third as long to a little longer than the lamina, rather stout, distinctly but not deeply channelled on the face, containing 5 vascular bundles, thickly sprinkled with minute sessile glands, and sparingly clothed with a few lanceolate and strapshaped acuminate denticulate and partially laciniate rather dark brown, concolorous scales, which are partially deciduous. Lamina firm, but not at all coriaceous, bright green, thickly sprinkled both above and below with minute sessile subglobular glands, triangular or deltoid-triangular, or more rarely triangular-lanceolate, tapering gradually towards the apex, truncate at the base, tripinnate or quadripinnate; lowest pair of pinnæ very unequally triangular, with several of the basal pinnules on the lower side of the secondary rachis much longer than those on the upper side, longer than the succeeding pair (rarely a little shorter), the others becoming gradually shorter towards the apex of the frond, shortly stalked, bipinnate; pinnules triangular-oblong or strapshaped-concave; those towards the base of the lamina stalked and pinnate, those towards the apex of the frond separate from each other, and pinnatipartite or incised, and then adnate by a narrow base and decurrent on the lower side. Ultimate pinnules or lobes with the apices incurved, inciso-serrate, with the teeth not incurved, more or less distinctly mucronate; ultimate veins not impressed on the upper surface, all running to the teeth of the ultimate segments. Sori occupying the whole frond, attached to the back of the first anterior branch of the ultimate mid-veins, forming a line on each side of the ultimate pinnules or ultimate segments, about equidistant from the mid-vein and the margin of the pinnule or segment, and extending nearly to its apex. Indusium rather firm, persistent, roundish-reniform, convex (often very much so), denticulate, with a few sessile and globular glands round the margin, and in some cases with very slender jointed filaments terminated by minute glands. Spores bluntly tuberculate, with a few sparse large rounded tubercles. No sterile fronds dissimilar to the fertile ones.

On rocks and banks, and in woods. Local. Frequent in the south-west of England, extending east to Sussex and to Kent, near Tunbridge Wells; north of this it occurs in Hereford, Salop, Glamorgan, Pembroke, Merioneth, Carnarvon, Anglesea, North Lancashire, West Yorkshire, Cumberland, and the Isle of Man, with outlying stations in Forge Valley near Scarborough, Chevington Wood near Workworth, Rugely Wood near Alnwick, and several stations near Embleton, Northumberland. Dumbarton, the Clyde Isles, Mull and Skye, and the Hebrides; recorded from Berwick, Roxburgh and Forfar. It is abundant in the Wauk Mill Bay, Orphir, Orkney; and the late Dr. T. Anderson found it rather common in Hoy, but there I have only seen it on Hoy Hill, and in Fara and Calf of Flotta; Dr. H. Halcro Johnson informs me that it is abundant on the Calf of Cava, in Scalpa Flow. In Ireland it is distributed from north to south, but it is most plentiful in the west.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex producing a number of crowns, which are closely packed together, in this respect resembling the caudex of L. rigida. Fronds 8 inches to 3 feet high, of which the stipes is usually about half; it is, for more or less of its length from the base upwards, tinged with purplish-brown, and is not so deeply furrowed as in L. dilatata and L. spinulosa. Lamina vivid green, crisped, from the tips of the ultimate pinnules and segments being turned upwards, covered on both sides with minute glands like those of L. rigida, which it also resembles in the texture of its fronds, which are firm and almost rigid, without being coriaceous. Veins clavate towards the apex, as in the other species, and not extending quite to the teeth of the lobes. Sori large, with the indusium much more convex than in the other spinulose Lastreæ, almost as much so as in L. rigida. In British specimens the jointed filaments round the edge of the indusia can seldom be found, though I have observed them in Plymouth specimens; but in those from the Azores they are much more frequently met with. The spores resemble those of L. Filix-mas, L. rigida, L. cristata, and L. spinulosa, in having a few large rounded tubercles and no minute acute ones.

This Fern has been confounded with L. dilatata, but it is scarcely possible to mistake them when the plants are alive. The bright green colour of the frond, its crisp texture and concave pinnæ, readily distinguish it. It has also a peculiar sweet scent, which has been compared to the odour of fresh hay, though I do not myself perceive the resemblance. When protected from frost the fronds are truly evergreen, the old ones remaining until the young ones appear in May, and the fronds begin to decay at the extremity, and not near the base of the rachis. The scales are fewer, narrower, and some of them laciniate, with one or two large acute segments, and they are destitute of the dark stripe which is so commonly found in those of L. dilatata; the lowest pair of pinnæ are much larger, generally longer than any of the succeeding pairs, and the frond is sprinkled with round, sessile, not stalked or clavate glands; the sori are generally more abundant; the indusia are much more convex, and the spores are not muricated.

Hay-scented Fern.

GENUS IX.—**POLYSTICHUM.** *Roth.*

Fronds produced from the extremity of the caudex, approximate and tufted, or solitary, usually coriaceous, once or more times pinnate. Stipes not articulated to the caudex. Veins all free. Sori punctiform, round, at the extremity of the ultimate veins or attached to some portion of their back. Indusium roundish, peltate, attached by the centre : rarely the indusium is absent or fugacious.

Name from πολύ (*polu*) much, and στικτός (*stiktos*) spotted or punctured, from the numerous sori.

SPECIES I.—**POLYSTICHUM LONCHITIS.** *Roth.*

PLATE 1859.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 43.

Aspidium Lonchitis, *Swartz. Sm.* Eng. Fl. Vol. IV. p. 284. *Hook. fil.* Stud. Fl. p. 464. *Hook. & Baker*, Syn. Fil. ed. ii. p. 250. *Milde*, Fil. Europ. p. 104. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 976. *Fries*, Summ. Veg. Scand. p. 82. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 630. *Rabenh.* l. c. No. 43.

Polypodium Lonchitis, *Linn.* Sp. Pl. 1518. *Sm.* Eng. Bot. ed. i. No. 797.

Caudex rather short and thick, decumbent, not breaking into separate crowns for many years. Fronds numerous, all similar, arranged in shuttlecock fashion, spreading-ascending, evergreen. Stipes very short, thickly clothed with large and small triangular-ovate or ovate-lanceolate erose-denticulate brown concolorous scales. Lamina coriaceous, rigid, dark green, shining, much paler beneath, strapshaped, tapering gradually at the base and apex, pinnate; rachis thickly clothed with lanceolate, and the under surface of the frond sparingly clothed with linear scales, many of which are deciduous; pinnæ very shortly stalked, oblong-triangular or strapshaped-triangular, the lower ones deltoid, all more or less auriculate at the base on the anterior side, and more or less evidently doubly serrate, with the middle tooth of each serrature prolonged into a rigid spine. Ultimate veins not impressed on the upper surface, but deeply so beneath, running from the mid-vein of the pinna and auricle to the margin, and giving off one or two branches, which run to the base of the teeth. Sori commonly confined to the upper half or third of the frond, but occasionally extending further down, round, attached to the first anterior branch of each of the ultimate veins, and forming a line on each side of the mid-vein of the pinna, about equidistant from the mid-vein and the margin, with a loop at the base extending into the auricle, and in luxuriant plants sometimes with a second short line between the primary one and the margin on the base of the upper side of the pinnæ immediately above the auricle. Indusium umbilicate, circular, dentate at the margin, soon shrivelling. Spores tuberculate, with rather large very prominent obtuse tubercles, intermingled with numerous smaller and more acute ones.

Among rocky débris on mountains. On Snowdon and the neighbouring mountains; the Yorkshire mountains; Teesdale, Durham, nearly, if not quite extinct; Helvellyn, Cumberland; Westmoreland; between Alnwick and Morpeth, Northumberland. Frequent in the Scotch Highlands, extending to Sutherland; Hoy Hill, Orkney (Dr. J. Anderson), and in fissures of rocks, Greenigoe, Hoy (Dr. A. A. Duguid). Mangerton and Brandon mountain, county Kerry; Ben Bulbin and the neighbouring mountains, co. Sligo; Glenade mountain, Leitrim. "Near Lough Eske, Donegal, and also Rosses and Fanet," are probably errors. (See 'Journal of Botany,' 1881, p. 240.) The 'Cybele Hibernica,' in addition to these localities, mentions that a single root was found near Edgworthstown, Longford, and a single root on a hedgebank near Dungannon, Tyrone.

England, Scotland, Ireland. Perennial. Autumn.

Caudex apparently of very slow growth, rarely above 1¼ inch in diameter. Fronds 3 to 18 inches long, by 1 to 2¼ broad, very rigid, appearing in June or July, and remaining after the fronds of the succeeding year are developed. Stipes very short, sometimes consisting only of the dilated base, which remains permanently attached to the caudex, and is rarely above 1 or 2 inches long, containing 5 vascular bundles, clothed with very large scales, intermixed with much smaller ones. Pinnæ twisted so as to make an angle with the general plane of the frond, with the spines variable in length, but usually about $\frac{1}{10}$ inch long. Sori rather large, and ultimately confluent.

Alpine Holly-fern.

SPECIES II.—POLYSTICHUM LOBATUM. *Presl.*

PLATE 1860.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 22.

P. aculeatum, *Roth.* *Bab.* Man. Brit. Bot. ed. vii. p. 449. *Moore,* Handbk. Brit. Ferns, ed. iii. p. 81; and Nat. Print. Brit. Ferns, 8vo. ed. Vol. I. p. 123. *Newm.* Hist. Brit. Ferns, ed. iii. p. 111.

Aspidium lobatum, *Schkuhr.* *Kunze,* Bot. Zeit. 1848, p. 356. *Milde,* Fil. Europ. p. 105.

A. aculeatum, *Willd.* Sp. Plant. Vol. V. p. 258.

A. aculeatum, *a.* vulgare, *Döll.* *Koch,* Syn. Fl. Germ. et Helv. ed. ii. p. 976. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 630.

Polypodium lobatum, *Huds.* Fl. Ang. p. 459.

Caudex short, thick, decumbent or erect, not breaking into separate crowns for several years. Fronds numerous, all similar, arranged in shuttlecock fashion, ascending or slightly arching backwards, evergreen. Stipes very short, thickly clothed with large and small triangular-ovate or ovate-lanceolate erose-denticulate dusky brown concolorous scales. Lamina coriaceous, rigid, dark green, shining, much paler beneath, narrowly elliptical-oblong or oblong-strapshaped, tapering gradually at the base and apex, bipinnate; rachis rather thickly clothed towards the base with lanceolate scales, and throughout its whole length with numerous reddish-brown hair-like scales, many of which are deciduous; pinnæ very shortly stalked, strapshaped-acute, the lower ones deltoid triangular or triangular, much shorter than the succeeding pair, pinnate; pinnules usually pointing towards the apex of the pinna, oblong or ovate, falcate or rhomboidal, commonly more or less distinctly auricled at the base on the anterior side, with the basal angle by which they are attached usually less than a right angle; those towards the base of the pinnæ more or less distinctly stalked, all coarsely spinous-serrate, more rarely doubly serrate; serratures prolonged into rigid spines.

Ultimate veins scarcely impressed on the upper surface, but deeply so beneath, running from the mid-vein of the pinnule and auricle to the margin, giving off 1 or 2 branches, which run to the base of the teeth. Sori commonly confined to the upper half of the frond, round, attached to the first anterior branch of each of the ultimate veins, and forming a line on each side of the mid-vein of the pinnule about equidistant from the mid-vein and the margin, with a loop at the base extending into the auricle, and in luxuriant plants sometimes with a few sori between the line and the margin on the anterior side of the pinnule, immediately above the auricle. Indusium flattish, strongly umbilicate, circular, denticulate at the margin, soon shrivelling. Spores tuberculate, with rather large very prominent obtuse tubercles, intermingled with numerous smaller and more acute ones.

Var. α. *genuinum.*

Aspidium lobatum, *Smith*, Eng. Bot. ed. i. No. 1563; and Eng. Fl. Vol. IV. p. 291. *Hook. & Arn.* Brit. Fl. ed. viii. p. 582. *Hook. fil.* Stud. Fl. p. 465.
A. aculeatum, var. α. lobatum, *Hook. & Bak.* Syn. Fil. ed. ii. p. 252.

Caudex attaining a considerable age before dividing; the crowns of very old plants cæspitose. Fronds spreading-ascending, arching backwards when large, rather rigid, tapering greatly towards the base; lowest pair of pinnæ usually very short, and shorter than the succeeding pair; pinnules not distinctly stalked, but attached by a narrow base, which is decurrent on the lower side, many of them towards the apex of the pinnæ, and the whole of them towards the apex of the frond, not separated from each other; so that these pinnæ, and parts of pinnæ, are only pinnatipartite or pinnatifid—not pinnate.

Var. β. *aculeatum.*

Aspidium aculeatum, *Sm.* Eng. Bot. ed. i. No. 1562; and Eng. Fl. Vol. IV. p. 290. *Hook. & Arn.* Brit. Fl. ed. viii. p. 582. *Hook. fil.* Stud. Fl. p. 465 (?).
A. aculeatum, β. aculeatum, *Hook. & Bak.* Syn. Fil. ed. ii. p. 252.

Caudex attaining a great age before dividing, and even in very old plants sometimes undivided. Fronds spreading-ascending, not arching backwards, very rigid, not tapering very much towards the base, and sometimes almost abrupt; lowest pair of pinnæ usually scarcely shorter than the succeeding pair; many of the pinnules distinctly stalked, set on more at right angles to the rachis of the pinna than in var. *lobatum*, and fewer of them towards the apex of the pinnæ, and frond confluent. Fronds of a darker green than in var. α.

On rocks, hedgebanks, and woods; rather sparingly but widely distributed over England and Scotland, north to Skye, Ross-shire; Hoy, Orkney (Dr. H. H. Johnston). Local, but widely distributed in Ireland.

Var. β apparently much rarer, and probably not extending north to Scotland: but the authors of the 'Cybele Hibernica' speak of the form A. lobatum, Sm., as being rare in Ireland, so that we may infer that the var. β is the commoner in that island.

England, Scotland, Ireland. Perennial. Summer.

Caudex 1½ inch or more in diameter, breaking into a few crowns when old, which remain close together, so that the plant becomes tufted. Stipes short and thick, from 2 to 5 inches, closely covered with large scales, intermixed with minute ones. Fronds 1 to 2 feet long, 3 to 7 inches broad, more parallel-sided when large than when small, at first with scattered hair-like scales beneath; appearing in May, and not perishing until the young fronds of the succeeding year.

Var. β has larger more rigid and more divided fronds (2 to 3 feet long); and, except in being more rigid than in var. α, it has the frond more resembling that of P. angulare; its caudex takes a longer time to form new crowns.

Young seedling plants of P. lobatum bear a very close resemblance to P. Lonchitis, being simply pinnate; they may always be distinguished, however, by their more parallel-sided fronds of much thinner texture, and having no fructification upon them: by the time they are sufficiently developed to have sori, the pinnæ have become at least deeply pinnatifid or pinnatipartite at the base; this form, which is sometimes called var. *lonchitidoides*, cannot be considered a true variety, because, if cultivated, it always develops into unmistakeable P. lobatum. On the other hand, when P. lobatum is weakened or starved, it tends to revert to the form *lonchitidoides* On this account it is impossible to agree with Bernhardi in uniting P. Lonchitis and P. aculeatum as forms of one species, though they are certainly very closely allied. P. lobatum, var. α, becomes more developed, stronger, and more divided, but does not change into β. *aculeatum*, though it is often impossible to distinguish dried specimens of vars. α and β from each other.

Hard Holly-fern.

SPECIES III.—**POLYSTICHUM ANGULARE.** *Presl.*

PLATE 1861.

Aspidium angulare, *Willd.* *Sm.* Eng. Fl. Vol. IV. p. 291. *Hook.* & *Arn.* Brit. Fl. ed. viii. p. 583. *Hook. fil.* Stud. Fl. p. 465.

A. aculeatum, *Milde*, Fil. Europ. p. 106.

A. aculeatum, var. angulare, *Gren.* & *Godr.* Fl. de Fr. Vol. III. p. 630. *Hook.* & *Bak.* Syn. Fil. ed. ii. p. 252.

Polypodium aculeatum, *Huds.* Fl. Angl. p. 459.

"P. setiferum, *Forsk.* Fl. Ægypt. Arab. p. 185" (teste *Moore*).

Caudex short or elongated, very thick, decumbent or erect, breaking into several crowns after a few years. Fronds very numerous, all similar, arranged in shuttlecock fashion, ascending, sub-evergreen. Stipes short or rather short, very thickly clothed with large triangular-ovate erose-denticulate ferruginous scales, intermingled with numerous hair-like ones, and very numerous small whitish scurf-like scales. Lamina firm, but not coriaceous, flaccid, bright green, scarcely shining, much paler beneath, narrowly elliptical-oblong or oblong-strapshaped, tapering at the apex, abrupt at the base, bipinnate or tripinnate; rachis thickly clothed towards the base with lanceolate scales, and for about half-way up with whitish fimbriated scurf-scales, and for its whole length with very numerous reddish-brown hair-like scales, most of which are persistent; pinnæ very shortly stalked, pinnate or bipinnate, strapshaped, acute, the lower ones similar to the others, and not much shorter than the succeeding pair; pinnules ovate and falcate, rarely rhomboidal, commonly auricled at the base on the anterior side, with the basal angle by which they are attached commonly greater than a right angle, most of them distinctly stalked, inciso-spinous-serrate or doubly-serrate or pinnatifid or even pinnate; serratures prolonged into weak spines. Ultimate veins scarcely impressed on the upper surface, but very deeply so beneath, running from the mid-vein of the pinnæ, auricles and larger lobes, giving off one or two branches which run to the base of the teeth, the first anterior branch usually to the notch between the teeth. Sori occupying the upper half or two-thirds of the frond, attached to the first anterior branch of the ultimate veins, and forming a line on each side of the mid-vein of the pinnule, nearer the mid-vein and the margin, with a loop at the base extending into the auricle, then (in luxurious plants) sometimes with a few sori between the principal line and the margin on the anterior side of the pinnule immediately above the auricle. Indusium convex, slightly umbilicate, circular, denticulate at the margin, and soon shrivelling. Spores tuberculate, with rather large very prominent obtuse tubercles, intermingled with numerous smaller and more acute ones.

Var. *α. genuinum.*

Pinnules broad, spinous-serrate or inciso-serrate, not decurrent, with their basal angle a right angle or more than a right angle.

Var. *β. hastulatum.* Kunze.

Pinnules broad, more or less deeply pinnatifid or pinnatipartite or pinnate, not decurrent, with their basal angle a right angle or more than a right angle.

Var. (?) *γ. alatum.* Moore.

Pinnules broad, faintly spinous-serrate, decurrent on the posterior side, and united to the narrow wing along the rachis to the pinna, with their basal angle a right angle or more than a right angle.

Var. *δ. gracile.* Wollaston.

Pinnules narrow, inciso-serrate, not decurrent, with their basal angle less than a right angle.

On hedgebanks and in woods. Frequent in England. Rare in Scotland, extending north to the counties of Berwick, Roxburgh, and Ayr, and the Clyde islands ; it is also reported from Loch Gilphead, Argyleshire ; but the only Scotch specimen I have seen is from the Cumbraes, kindly sent me by Mr. G. Horn. It occurs throughout Ireland, and is abundant in many parts of the west and south of that island. Var. *β*, in various forms, is not uncommon in damp shady situations in the south of England and Ireland. Var. *γ*, Selworthy, Somersetshire, and near Ottery St. Mary's, Devonshire (Mr. Wollaston). Var. *δ*, Devon, Somerset, and Ireland ; but it is rather a monstrosity than a true variety.

England, Scotland, Ireland. Perennial. Summer.

Fronds 18 inches to 4 feet high or more, and 4 to 10 inches wide. Stipes 2 to 6 inches long, containing 5 vascular bundles, as in P. Lonchitis and P. lobatum ; but it is much more densely scaly, and the scales are much brighter in colour, being reddish-brown instead of dusky brown. The under side of the frond has more numerous hair-like scales, and these are more persistent. The frond is much softer in texture, of a brighter and yellower green, more abrupt at the base, from even the lowest pinnæ being elongated so that the frond does not taper insensibly to the base; the pinnules are smaller in proportion, more distinctly stalked, and with a greater basal angle than those of P. lobatum, and fewer of them towards the apex of the pinnæ and towards the apex of the frond are confluent. The indusia are larger and more convex.

The seedling form of P. angulare apparently never has the close resemblance to adult P. Lonchitis which that of P. lobatum has, for it has an elongated stipes and an abrupt-based frond, with deeply pinnatifid lower pinnæ, even though it may be but a couple of inches long.

P. angulare is much more sensitive to frost than P. lobatum. In Balmuto Garden the former has its fronds always destroyed during the winter; while those of P. lobatum remain green until the new fronds are developed in summer.

Var. β, which Wilde considers the Aspidium hastulatum of Tenore, bears much the same relation to the ordinary form of P. angulare that the var. *affinis* of Lastrea Filix-mas bears to the var. *genuina* of that species.

The var. *alatum* of Moore shows an approximation to P. lobatum, var. *aculeatum*, in having the pinnæ running into a narrow herbaceous wing along the rachis; but in texture, form of frond, and pinnæ it agrees with the type of P. angulare.

Var. *gracile*, with other forms, called by fern-cultivators *lineare*, *grandidens*, *confluens* and *proliferum*, are remarkable for their narrow lanceolate incised pinnæ, with wedge-shaped bases, not strongly curved on the posterior side, so that in this they also show some approach to P. *lobatum*, but the forms are usually malformed or monstrous.

P. angulare is a special favourite with fern-growers, as it produces a great number of curious and abnormal deviations, there being over 150 named forms in cultivation.

It is remarkable that P. Braunii (Aspidium Braunii, Milde, Fil. Europ. p. 108) growing in continental Europe has not occurred in Britain; it appears to be the only one of the group of plants included in the Polypodium aculeatum of Linnæus which occurs in Norway and Sweden, and in North America. Mr. Moore considers it as a variety of P. angulare; but Milde regards it as a subspecies equally distinct from P. angulare (which he calls aculeatum) and from P. lobatum, under which he includes the aculeatum of Smith. In texture and habit it agrees with P. angulare, but the fronds taper insensibly to the base, and have a very short stipes, as in P. lobatum. The pinnæ are larger in proportion than P. angulare, and have numerous hair-like scales when young, not only on the lower, but on the upper surface, which is not the case in P. angulare or P. aculeatum; and the sori are larger than those of P. angulare, and much less numerous.

I have not seen the plant alive, but the large scales of the stipes seem paler in colour than in P. angulare; and, judging from dried specimens, the seedling state is more similar to the adult.

Soft Holly-fern.

GENUS X.—**WOODSIA.** *R. Brown.*

Fronds produced from the upper part of the caudex and its branches, approximate or tufted, once pinnate, rarely bipinnate, often scaly beneath. Stipes not articulated to the caudex, but with an articulation at some distance above the base. Veins all free. Sori punctiform, round, attached to the back of the ultimate veins below their apex. Indusium calyciform, surrounding the sorus, cut into long segments nearly to the base.

Name in honour of Joseph Woods, a celebrated English botanist.

SPECIES I.—**WOODSIA ILVENSIS.** *R. Brown.*

PLATE 1862.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 15.
W. rufidula, *Beck.* *Milde*, Fil. Europ. p. 164.
W. Raiana, *Newm.* Hist. Brit. Ferns, ed. ii. p. 140, and ed. iii. p. 73 (a suggested name only).
W. hyperborea, *β.* rufidula, *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 975.
Acrostichum Ilvense, *Linn.* Spec. Plant. p. 1528.
Polypodium Ilvense, *Swartz*, Syn. Fil. p. 39.
Aspidium rufidulum, *Swartz*, Syn. Fil. p. 58.
Lastrea rufidula, *Presl*, Pter. p. 76.

Caudex short, dividing into a number of small crowns, which are closely packed together. Stipes breaking off by an articulation a little below the middle, reddish, with broadly-lanceolate pale brown scales at the base, and numerous narrow and hair-like mostly deciduous scales in the upper part. Lamina oblong-strapshaped or triangular-strapshaped, pinnate or bipinnate; pinnæ triangular-oblong or triangular-strapshaped, deeply pinnatifid or pinnatipartite, or even pinnate towards the base, usually thinly clothed above and thickly clothed beneath with long hairs, which are at first whitish, afterwards reddish-brown and partially deciduous; lobes oblong or ovate, obtuse or rounded, crenate or entire; rachis and mid-veins of the pinnæ with numerous long linear acute scales. Indusium saucer-shaped, divided into numerous filiform segments, which are much longer than the undivided portion, and incurved over the sori.

On ledges of rock. Rare and very local. In Carnarvonshire Clogwyn-y-Garnedd, and Llwyn-y-Cwm on Glyder Vawr (Mr. W. Wilson); Pass of Llanberis, left-hand side, looking towards Capel Curig (Mr. L. Clark); on Falcon Clints, Teesdale, Durham, now nearly or quite extinct (Mr. J. G. Baker); in Westmoreland, on three different mountains; and Cumberland (Messrs. T. Huddart and F. Clowes). Abundant on steep crumbling rocks, on the hills dividing Dumfries from Peebles-shire; Ben Chouzie, Perthshire (Prof. Balfour); Glen Fiadh, Clova mountains, Forfar (Mr. H. C. Watson).

England, Scotland. Perennial. Summer, Autumn.

Fronds ascending, annual, perishing in autumn, usually not more than 2 or 3 inches high in British specimens; but I have one 5 inches long, from the Rev. W. Little, from hills north of Moffat, and Norwegian ones, 6 or 7 inches, of which the stipes is about half in the larger specimens, but in some of the smaller only a quarter; the extreme breadth is ½ to ¼ the length: the specimens with the longest lamina are narrower in proportion than those with the lamina shorter. The frond is of a dull green above, with a somewhat velvety texture, and ultimately more or less reddish beneath, from the abundant scales and hairs, and hair-like segments of indusium. Pinnæ varying considerably in the degree of separation between the lobes, which are sometimes reduced to crenatures. Ultimate veins free. Sori near the apex of the ultimate veins, at length confluent. Spores with a few large blunt tubercles.

Oblong Woodsia.

SPECIES (?) II.—WOODSIA HYPERBOREA. *R. Brown.*

PLATE 1863.

Rabenh. **Crypt. Vasc. Europ. Exsicc. No. 82.**
W. Arvonica, *Milde*, Fil. Europ. p. 161.
W. alpina, *Newm.* Nat. Alm. 1844, p. 13; and Hist. Brit. Ferns, ed. iii. p. 79. *Moore*, Nat. Print. Brit. Ferns, 8vo ed. p. 283; and Handbk. Brit. Ferns, ed. iii. p. 251.
Acrostichum hyperboreum, *Liljeblad*, Stock. Trans. 1793, p. 201.
A. alpinum, *Bolton*, Fil. Brit. p. 76 (1790).
Polypodium hyperboreum, *Swartz*. *Sm.* Eng. Bot. No. 2023.
P. Arvonicum, *Sm.* Fl. Brit. Vol. III. p. 1115.

Caudex dividing into a few small crowns, which are closely packed together. Stipes breaking off by an articulation a little below the middle, reddish, with broadly lanceolate pale brown scales at the base, and a few narrow and hair-like deciduous scales. Lamina linear-strapshaped or oblong-strapshaped, pinnate; pinnæ deltoid or deltoid-triangular, rarely oblong-triangular, pinnatifid, very thinly clothed with long hairs above and beneath; lobes roundish or oval-obovate, entire; rachis with very few scales, and mid-veins of the pinnæ with none. Indusium saucer-shaped, divided into numerous filiform segments, which are much longer than the undivided portion and incurved over the sori.

On ledges of rock, very rare and local. In Carnarvonshire, on Clogwyn-y-Garnedd, Snowdon, on precipices facing east and north-west; rocks facing the east above Glas-Lwyn (L. Clark); Moel Lachog, Pass of Llanberis (Mr. L. Clark and Mr. T. Moore). Perthshire, Ben Chouzie, near Crieff (Dr. Balfour); Ben Lawers (Mr. Dickson and Mr. W. Wilson); and in addition to these stations, Dr. Buchanan White has seen it on Larig-au-Lochan, Cam Creag, and Ben Laoigh; it is reported from Craig Challiach and Mael-dun-Crosk; I have gathered it on Catjaghiamman and on the mountains which separate Glen Lochy from Glen Dochart. Glen Isla, Clova, Forfar (Mr. J. Roy).

England, Scotland. Perennial. Summer, Autumn.

Plant growing in tufts of smaller size than in W. Ilvensis, and with the fronds more persistent and usually smaller, 1 to 2 inches being the average length, and 6 inches the largest I have seen, of which the petiole is generally less than one-half. Breadth of lamina ¼ to ¾ inch. Pinnæ shorter and broader at the base than in W. Ilvensis, with fewer and shallower lobes; and above all, without the thick covering of reddish hairs and scales which are on the under side of the fronds of W. Ilvensis.

Mr. Roy's specimens from Glen Isla have broader fronds, with longer, narrower, and more deeply divided pinnæ, more like those of W. Ilvensis than of W. hyperborea, but they are destitute of scales on the mid-veins of the pinnæ; but some of the Moffat specimens of W. Ilvensis are almost destitute of these scales, while in others they are abundant, so that I think it very probable those authors are right who treat them as merely subspecies. Mr. Wollaston informed the late Mr. Newman that in W. hyperborea the frond has its clusters of capsules very conspicuous, even in its youngest state and immediately it begins to unfold, and that its fronds are nearly persistent. In W. Ilvensis the sori are not apparent until the frond has attained its full size, and the fronds wither in autumn.

Alpine Woodsia.

GENUS XI.—CYSTOPTERIS. *Bernh.*

Fronds produced from the upper part of the caudex and its branches, approximate or solitary, once or more times pinnate, not scaly beneath. Stipes not articulated to the caudex, nor in any portion of its length. Veins all free. Sori punctiform, round, attached to the back of the ultimate veins. Indusium hooded, attached below the sorus, entire.

Name from κύστις (*kustis*) a bladder, and πτέρις (*pteris*) a fern, on account of the hooded indusium.

SPECIES I.—CYSTOPTERIS FRAGILIS. *Bernh.*

PLATES 1864, 1865, 1866, 1867.

Polypodium fragile and P. regium, *Linn.* Spec. Plant. 1553.

Caudex short, rather stout, dividing into numerous short branches or crowns, clothed with the more or less approximate bases of former fronds. Fronds several, close together at the apex of each branch or crown of the caudex. Stipes from one-third as long as to as long as the lamina, slender, very brittle, rarely stouter and tough, with sparse pale linear-lanceolate scales at the base, and a few hair-like deciduous ones in the upper part, but no glands. Lamina perishing in autumn, or sub-evergreen, oblong-lanceolate or strapshaped-lanceolate, subtripinnate or bipinnate, lowest pair of pinnæ almost always smaller than the succeeding pair, and never conspicuously larger; pinnules serrate or crenate or pinnatifid or pinnatipartite; teeth of ultimate segments usually entire, with the ultimate veins running in their apices, or notched with the veins running into the notches; rachis and lamina usually without glands. Indusium generally without glands, rarely glandular. Spores muricated with numerous long slender acute spine-like tubercles, or tuberculated with sparse large blunt tubercles.

SUBSPECIES I.—Cystopteris eu-fragilis.

PLATES 1864, 1865.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 14.
C. fragilis, *Milde*, Fil. Europ. p. 147.

Caudex short, rather stout, not creeping, dividing into several short branches or crowns, clothed with the more or less approximate bases of former fronds. Fronds several, close together at the apex of each branch or crown of the caudex. Stipes from one-third as long as to as long as the lamina, slender and very brittle, with sparse pale linear-lanceolate scales at the base, and a few hair-like deciduous ones in the upper part, but no glands. Lamina perishing in autumn, oblong-lanceolate or strapshaped-lanceolate, subtripinnate or bipinnate; lowest pair of pinnæ almost always smaller than the succeeding pair, and never conspicuously larger; pinnules serrate or crenate or pinnatifid, or more rarely pinnatipartite; teeth of ultimate segments usually entire, with the ultimate veins running into their apices; rachis and lamina almost always without glands. Indusium without glands, usually denticulate. Spores muricated with numerous long slender acute spine-like tubercles.

Var. α. *genuina.*

PLATE 1864.

Cyathea fragilis, *Sm.* Eng. Bot. No. 1587; and Eng. Fl. Vol. IV. p. 298.

Lamina oblong-lanceolate, subtripinnate.

Var. β. *dentata.* Hook.?

PLATE 1865.

Cyathea dentata, *Smith*, Eng. Fl. Vol. IV. p. 300; and Cyathea angustata, *Sm.* Eng. Fl. Vol. IV. p. 301; and *Sowerby*, E. B. S. No. 2790.

Lamina strapshaped-lanceolate, more parallel-sided and narrower than that of var. α, bipinnate or subpinnate.

On ledges of rock, and on walls, and among loose stones. Sparingly distributed throughout England and Scotland, except in mountainous districts where it is common; from Cornwall, Devon and Dorset, extending north to Hoy Hill and Rousay in Orkney. Local, but widely distributed throughout Ireland.

Var. β appears to be confined to mountainous districts; at least I have not seen it except from such.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant growing in small tufts. Branches of the root-stalk elongating but little, the crown covered with ovate-lanceolate pale brown glabrous scales. Fronds 3 inches to 1 foot high (rarely more), of which the stipes is usually about one-third and rarely one-half, brown at the base, green and widely channelled above the middle, and containing 2 vascular bundles with oval sections. Lamina thin and flaccid, deep green when growing in shade, and yellowish-green when exposed to the sun, not shining, very variable in its degree of division and in the shape of its ultimate segments, which are sometimes acute, sometimes obtuse, and vary from pinnatipartite to serrate or crenate, with the bases sometimes greater than a right angle, at other times wedge-shaped, often more or less decurrent on the lower side. From this extreme variability of shape and cutting of the pinnules or segments, I have been compelled to adopt the general outline of the frond as the mode of separating C. eu-fragilis into two varieties.

Var. *dentata* when typical has the frond not more than bipinnate, sometimes scarcely even bipinnate, and both the pinnæ and the pinnules are blunter at the apex than in the common form. Professor Babington states that the spores of var. *dentata* are "warted," but in all the specimens named '*dentata*' I have examined they have the long sharp spur-like tubercles characteristic of C. eu-fragilis.

Milde, under var. *dentata*, gives an Algerian form from Blidah, collected by G. Munby, which has verrucose spores. This I have not seen, but certainly should not refer it to eu-fragilis at all, as the striking difference between the spores seems to me the only tangible difference between C. eu-fragilis and C. alpina.

C. angustata, Sm., appears rather a finely cut form of var. *dentata* than a narrow form of var. *genuina.*

Brittle Bladder-fern.

SUBSPECIES (?) II.—**Cystopteris alpina.** *Desv.*

PLATES 1866, 1867.

Milde, **Fil. Europ. p. 150.**

Caudex short, rather stout, dividing into several short branches or crowns, clothed with the more or less approximate bases of former fronds. Fronds several, close together at the apex of each branch or crown of the caudex. Stipes from one-third as long as to as long as the lamina, slender and very brittle, with pale linear-lanceolate scales at the base, and a few hair-like deciduous ones in the upper part, but no glands. Lamina perishing in autumn, oblong-lanceolate or strap-shaped-lanceolate, subquadripinnate or subtripinnate or rarely bipinnate; lowest pair of pinnæ always smaller than the succeeding pair, and generally conspicuously smaller; pinnules bipinnatifid or bipinnatipartite, rarely only pinnate; teeth of ultimate segments mostly notched, with the ultimate veins running into the notches; rachis and lamina without glands. Indusium without glands, denticulate. Spores tuberculate, with sparse large blunt tubercles.

Var. α. *genuina.*

PLATE 1866.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 32.

C. alpina, *Link* ; *Hook. fil.* Stud. Fl. ed. ii. p. 495. *Hook. & Baker*, Syn. Fil. ed. ii. p. 103. *Hook. & Arn.* Brit. Fl. ed. viii. p. 588. *Gren. & Godr.* Fl. de Fr. Vol. II. p. 634.

C. regia, *Presl; Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 269. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 980.

Cyathea regia, *Forst.* *Sm.* Eng. Fl. Vol. IV. p. 302, in part.

C. incisa. *Sm.* Engl. Bot. ed. i. No. 163.

C. fragilis, var. alpina, *Bab.* Man. Brit. Bot. ed. vii. p. 450.

Aspidium alpinum, *Swartz*, Syn. Fil. p. 60.

Polypodium alpinum, *Wulfen.* *Jacq.* Collect. Vol. II. p. 171.

Polypodium regium, *Linn.?* Sp. Plant. No. 1553.

Frond subquadripinnate or tripinnate; pinnules attached by a slender base, pinnatipartite or bipinnatipartite; ultimate segments oblong and merely deeply notched, or oblanceolate and cut into oblong deeply-notched smaller segments. Ultimate veins almost all running into the notches of the segments.

Var. β. *Dickieana.* Milde.

PLATE 1867.

Milde, Fil. Europ. p. 151.

C. Dickieana, *R. Sim*, Gard. Journ. 1848, p. 308. *Newm.* Phyt. 1851, App. XXVI.; and Hist. Brit. Ferns, ed. iii. p. 94.

C. dentata (part), *Bab.* Man. Brit. Bot. ed. iii. p. 412; and ed. vi. p. 438.

C. fragilis, var. Dickieana, *Moore*, Handbk. Brit. Ferns, ed. i. p. 81; ed. iii. p. 234; and Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 256. *Bab.* Man. Brit. Bot. ed. vii. p. 450. *Hook. fil.* Stud. Fl. ed. ii. p. 494.

Frond subbipinnate; pinnules mostly attached by a broad base (except those next the rachis), inciso-crenate or pinnatifid; ultimate segments roundish, indistinctly notched or subentire. Ultimate veins running into the notches when these are present, or into the middle of the crenatures when these are not notched.

On rocks and walls, very rare. Var. α. Teesdale, Durham. Mr. Backhouse, 1872. Mr. Moore has received authentic specimens "said to have been gathered in Derbyshire and in Yorkshire, but without more particular habitats assigned," from Mr. H. Shepherd; but he "has not seen a native mountain specimen of C. regia, unless it be one from Saddleback in Cumberland, gathered many years since by Mr. S. O. Grey." ('Nat. Print. Brit. Ferns,' 8vo ed. Vol. II. p. 271.) It used to grow on a garden wall at Low Leyton in Essex, and I believe it is still to be seen on some walls in that village; but doubtless it has originally been an escape from cultivation.

Var. β. In a cavern south from the harbour of Cove, Kincardineshire, but now almost or quite extinct; originally found there by the late Professor Knight of Aberdeen, and distributed in a living state by Dr. Dickie. The late Mr. C. Barter states he found it on rocks about two miles beyond the Cove towards Lighthouse Point, where a small rill falls over the rocks (Phyt. series ii. 1855–56, p. 509): I do not know if this statement has been authenticated by competent authority. Dr. Dickie writes that he "saw it on dripping walls and rocks near the road about 3 or 4 miles north from Dunkeld, Perthshire." Very probably some of the stations given for C. eu-fragilis, var. *dentata*, belong to C. alpina, var. *Dickieana*.

England, Scotland. Perennial. Summer, Autumn.

Plant very similar to C. eu-fragilis, and about the same size. Fronds 3 inches to 1 foot long, or a little more. Var. α has the lamina commonly much more divided, and the primary pinnæ commonly shorter and more ovate in outline, and usually more abruptly pointed than in C. eu-fragilis: the narrow ultimate segments give the pinnæ some resemblance to those of Chœrophyllum Anthiscus.

Var. β bears a very close resemblance to C. eu-fragilis, var. *dentata*. In the wild plant of which I have seen but a single frond, both the pinnæ and the pinnules are crowded; the pinnæ slightly twisted and the basal pinnules decurrent, and those towards the extremity of the pinnæ confluent, so that the pinnæ are pinnatipartite at the base and simply pinnatifid towards the apex. When cultivated, however, seedlings present not only this form of frond, but others which are much more deeply divided, so that the pinnæ become bipinnate at the base and pinnatipartite towards the apex, and cease to be contiguous. The spores are precisely similar to those of C. alpina, having blunt rounded slightly elevated tubercles, and not long spine-like ones such as we find on the spores of C. eu-fragilis. This peculiarity of the spores Mr. Moore believes to have been first pointed out by Mr. Wollaston, and it is I think conclusive that Dr. Milde is right in referring the form Dickieana to C. alpina and not to C. eu-fragilis. As far as my experience goes, the sculpture of the spores is one of the most constant characters to be found among ferns; and after cultivating C. Dickieana for many years, I have come to the conclusion that the tuberculation of the spores remains constantly identical with that of C. alpina, and distinct from all the forms of C. eu-fragilis. In the more finely divided seedling plants there is a decided approach to the less divided forms of C. alpina, var. α, and the general outline of the frond is more like that of alpina than of C. eu-fragilis var. *dentata*, which resembles

Dickieana in the degree of division of the pinnæ and the rounded pinnules or segments. Besides the similarity of the spores Dickieana agrees with alpina in many of the ultimate veins running into the notches at the margin of the frond, and not into the teeth which border the notches. The notches, however, are much deeper in C. alpina, var. α, than in var. Dickieana, and in the latter the veins frequently run to the margin of the segment, where there is neither tooth nor notch. In C. eu-fragilis the veins, with scarcely any exception, run into projecting teeth. When first I read that Milde put Dickieana under alpina, I doubted, now I am quite convinced he was right.

Under C. alpina Milde includes Cystopteris Canariensis of Presl, which has the indusium studded with cylindrical hair-like glands; to this Midle refers the C. sempervirens of Moore, 'Nat. Print. Brit. Ferns,' 8vo ed. p. 268, which has been reported from Tunbridge Wells, Kent and Devon; but it seems probable it has either been planted or has escaped from cultivation in both places; it may be a distinct subspecies, as it has a tough (not fragile) stipes, and a frond which is evergreen if protected from frost, which is not the case with the fronds of either eu-fragilis, alpina, or Dickieana. I have specimens from the Canaries, from the late Mr. P. B. Webb, name Cyathea gracilis, Sm. These have the spores quite similar to those of C. alpina; but Moore says the spores of his C. sempervirens are muricate, so probably Canariensis and sempervirens are not identical.

Alpine Bladder-fern.

SPECIES II.—CYSTOPTERIS MONTANA. *Bernh.*

PLATE 1868.

Rabenh. Crypt. Vasc. Exsicc. No. 62.
C. myrrhidifolia, *Newm.* Hist. Brit. Ferns, ed. iii. p. 97.
C. Allioni, *Newm.* Phyt. 1851, App. xxv.
Cyathea montana, *Sm.* Mem. Acad. Roy. Sc. Journ. Vol. V. p. 417.
Aspidium montanum, *Swartz* in Schrad. Journ. Bot. Vol. II. p. 42 (1800).
Polypodium montanum, *Lam.* Fl. Fr. Vol. I. p. 23 (1778).
P. myrrhidifolium, *Villars*, Fl. Delph. p. 114 (1785).

Caudex elongated, slender, creeping, dividing into elongate slender branches, not covered by the approximate bases of former fronds. Fronds solitary, distant, produced from the sides of the branches of the caudex. Stipes from as long as to three or four times as long as the lamina, slender, not very brittle, with a few ovate-lanceolate acuminate entire very pale brown or white and hyaline gland-fringed and gland-tipped scales towards the base, and a few scattered narrowly lanceolate deciduous ones in the upper part, and also numerous minute cylindrical glands. Lamina perishing in autumn, deltoid, subternately tripinnate or subquadripinnate; lowest pair of pinnæ very much larger and more compound than the rest; pinnules incised, bipinnatifid or bipinnatipartite; teeth of the ultimate segments commonly notched, with the ultimate veins running into the notches; rachis and lamina more or less thickly sprinkled with minute cylindrical glands. Indusium thinly sprinkled with glands, or almost glabrous. Spores muricated, with numerous short rather thick blunt spine-like tubercles.

On wet mossy shady rocks. Rare and very local. It was first found in Britain by the late Mr. W. Wilton, on Ben Lawers, Perthshire, in 1836; Messrs. W. Gourlay and W. Adamson found it in 1841 on the Glenlochy Mountains, at a place called Corrach Uachdar, on Maol Oufillach, opposite Maol Ghaordie, where several other botanists have gathered it; Mr. Westcomb found it in the same district 6 or 8 miles from this last station; I have specimens from the late Rev. W. Little and Mr. G. Maw from Glenlochy; from Maol Ghaordie, Glenlyon, collected by Dr. Buchanan White, and Mr. J. Sadler, and from Ben Laoich, gathered by Dr. Buchanan White and Dr. H. H. Johnson. All these stations are in Perthshire. Mr. J. Backhouse has found it at the head of Canlochan Glen, Forfarshire; and it was found by Mr. A. Croall on the north side of shady rocks on the south side of Glen Callater, near its head, Aberdeenshire. I believe all the Scotch stations for this plant are on rocks of mica-slate facing the north, but the Aberdeenshire station may be an exception.

Scotland, Perennial. Summer, Autumn.

Caudex resembling that of Phegopteris Dryopteris, about the thickness of a stocking-wire, nearly black, the younger portion green clothed with large ovate hyaline scales. Fronds generally about ¾ inch apart, but often more. Stipes from 1½ inch to 1 foot long, with a shallow furrow on the anterior side, nearly as thick as the rootstock at the base where it is dark-coloured, tapering upwards, where it becomes green; the upper part is remarkable for the gland-fringed and gland-tipped scattered deciduous scales. Lamina 1¼ to 5 inches long, and nearly the same in width, resembling that of Phegopteris Dryopteris, but much more finely cut, and less evidently ternate.

Mountain Bladder-fern.

TRIBE IV.—ASPLENIEÆ.

Caudex not growing in advance of the fronds. Stipes not articulated to the caudex, and not separating from it. Sori oblong or linear, straight or curved, attached to the side of the veins, which are oblique to the midrib and margin of the frond or segment, generally furnished with an indusium attached longitudinally to the veins: rarely the indusium is absent.

GENUS XII.—**ATHYRIUM.** *Roth.*

Fronds produced from the apex of the caudex, usually approximated or tufted, rarely solitary, membranous, decompound. Stipes not articulated to the caudex, containing 2 vascular bundles which unite upwards, giving a horseshoe-shaped section towards the back of the stipes. Veins simple or forked, free. Scales composed of elongate cells, with their boundaries not thickened and uniform in colour with the rest of the cell. Sori oblong, rarely round, often curved or even horseshoe-shaped, attached along the side of the veins. Indusium attached to the vein of and the same shape as the sorus, sometimes crossing the vein and part of it attached to each side, sometimes rudimentary and fugacious or even absent.

Name from α without, and θυρεός (*thureos*), a shield, from not having a shield-shaped indusium.

In a natural arrangement of Ferns, Athyrium would occupy a place between Phegopteris and Lastrea; it has no affinity with Asplenium or any of the allied genera.

SPECIES I.—**ATHYRIUM FILIX-FŒMINA.** *Roth.*

No. 1869.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 24.

Asplenium Filix-fœmina, *Bernh.* *Hook. fil.* Stud. Fl. ed. ii. p. 493. *Hook. & Baker*, Syn. Fil. ed. ii. p. 227. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 981. *Fries*, Summ. Veg. Scand. p. 82. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 635.

Aspidium Filix-fœmina, *Swartz.* *Sm.* Engl. Bot. ed. i. No. 1459; and Engl. Fl. Vol. IV. p. 295.

Polypodium Filix-fœmina, *Linn.* Sp. Pl. 1551.

Caudex stout, erect or oblique, closely covered with the bases of former fronds, dividing early into numerous divisions or crowns, which remain closely packed together. Fronds several from each crown, arranged shuttlecock-fashion, dying in autumn. Stipes stout or rather stout, thickened immediately above the base, channelled on the anterior face, variable in length, thickly clothed at the base with lanceolate or ovate-lanceolate persistent brown scales, and rather sparingly above with lanceolate or strapshaped mostly deciduous brown scales. Lamina erect or spreading, elliptical-oblanceolate or narrowly elliptical-oblong or lanceolate-oblong, more or less attenuated towards or abrupt at the base, subbipinnate or subtripinnate or tripinnate; ultimate segments crenate or serrate or inciso-serrate; ultimate veins running into the teeth. Sori distributed over the whole of the frond, placed mostly on the anterior side of the first anterior branch of the veins running into the ultimate segments, oblong and more or less crescent-shaped or recurved at the apex, so as to be hooked or even horseshoe-shaped, rarely round. Indusium subpersistent, strongly fimbriate on the free margin, of the same form as the sori, the shape of which indeed is determined by that of the indusium; rarely it is fugacious or apparently wanting, in which case the sori are round and naked. Spores yellowish or yellowish-brown, nearly smooth, with a few small remote bluntish tubercles, rarely with numerous tubercles.

Var. α. *genuinum*.

Fronds spreading or arching backwards. Stipes short, one-sixth to one-third the length of the lamina. Lamina flaccid, elliptical oblanceolate or broadly elliptical, conspicuously convex-sided, tapering from above the middle to the apex, and longly attenuated towards the base; pinnæ decreasing in size downwards until the lowest pair is often not more than twice as long as broad; ultimate pinnules or segments oblong or oval-oblong or lanceolate, flat. Spore yellowish, nearly smooth.

Var. β. *erectum*.

A. Rhæticum, '*Roth.*' *Moore*, Handbk. Brit. Ferns, ed. ii. p. 136.
A. convexum, *Newm.* (part) Phyt. 1851, App. xiii., and Hist. Brit. Ferns, ed. iii. p. 212.

Fronds suberect. Stipes often rather long, from one-sixth to one-half the length of the lamina. Lamina rather firmer than in var. α, oblong elliptical or oblong, subparallel-sided, tapering more towards the apex than towards the base, which is rather abrupt; pinnæ not decreasing so much in length downwards as in var. α, and the lowest pair being many times longer than broad; ultimate pinnules or segments strapshaped or linear-triangular, often convex, with the edges recurved, at least when grown in exposed places. Spores yellowish, nearly smooth.

Var. γ. *Watsoni.*

A. incisum, '*Roth.*' *Newm.* (?) Hist. Brit. Ferns, ed. iii. p. 215. *Watson* in Lond. Cat. Brit. Pl. ed. vii. p. 27. See *H. C. W.* in Comp. Cyb. Brit. p. 622; and Top. Bot. p. 496.

Fronds suberect. Stipes long, about half the length of the lamina in the specimens I have seen. Lamina very firm, lanceolate-oblong or subtriangular-oblong, tapering towards the apex, but very little towards the base, which is very abrupt; pinnæ scarcely decreasing in length downwards, the lowest pair often as long as the succeeding pair; ultimate pinnules strapshaped-triangular, flat. Spores yellowish-brown, with numerous small blunt tubercles.

In woods, banks of streams, and on hillsides, moors, and ledges of rock. *α* and *β* common, and generally distributed.

Var. *γ* very scarce, and known only from roots in Mr. H. C. Watson's garden, which he supposes to have been brought from South Wales.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex dividing soon into a number of crowns, so that a patch of the plant increases rapidly, and assumes a tufted appearance from the numerous small crowns remaining together. Stipes commonly rather stout, containing two vascular bundles, which are very conspicuous in section, looking like two letters c turned back to back. Scales more or less numerous, brown, sometimes with a dark central stripe, the upper ones narrower than the lower, which are always most abundant on the thickened portion at the base of the stipes. Fronds very variable in the degree of approximation of pinnæ and pinnules, in the degree to which the latter are divided, and in the size to which they attain; fronds sufficiently developed to bear fructification, being found as small as 9 inches long, while in rich woods they attain 3 or 4 feet in height.

The different forms, however, vary so much when cultivated, not merely in size but in the approximation of the pinnæ and pinnules, as well as in the general shape and division of the latter, that it seems best to distribute the ordinary forms under two varieties only, and very often even these are distinguished with difficulty.

Var. *α* has the fronds ascending, and, when large, recurved at the apex, so as to be drooping. The stipes and rachis seem to be always green, the frond thin in texture, and the ultimate pinnæ flat. Athyrium molle, Roth, Newman, appears to me merely a young or weak form of var. α: it has the pinnules approximate, only serrate or crenate, and often connected by a wing on each side of the partial rachis, so that the frond is scarcely so much as bipinnate; but wild specimens having these characters, although large enough to bear sori, on being transplanted into rich soil and cultivated, have developed into the larger and more compound forms of var. α, which we find growing naturally in woods. If these small forms be cultivated in pots or on dry rock-work, the dwarf and little-divided state of the fronds remains constant, and it is perhaps from treating them in this manner that the idea has originated that *molle* is a permanent variety. Var. *marinum*, Moore, var. *confluens*, Moore, var. *allatum*, Moore, and var. *latifolium*, Bab., seem to me all small forms of var. α, while the beautiful form "*plumosum*" (Phegopteris plumosa, J. Smith, 'Ferns British and Foreign,' p. 28), which has tripinnate fronds and strapshaped serrate or inciso-serrate, longly-acuminate ultimate pinnules, can only be considered as a monstrosity, as it either does not fruit at all, or produces round sori without an indusium or with a very rudimentary one. The original plant of *plumosum* was found near Skipworth in Yorkshire, by Mr. J. Horsefall, and from the spores of these, plants similar to the parents have been raised. This propagation of abnormal forms by spores may perhaps, as previously stated, be owing to asexual production of plants from the prothallia similar to that observed in Pteris serrulata; these plants would then be merely produced by budding, and therefore retain all the peculiarities of the individual from which they were derived. Forms more or less approximating to *plumosum* have been found in various localities. I am favoured with a specimen cultivated from Mr. G. B. Wollaston, labelled from Dorsetshire, J. S. Wells. This, however, is not so completely tripinnate as the Yorkshire plant, though very nearly so, and the ultimate segments are shorter and broader. I possess one received from Messrs. Sang of Kirkcaldy, in which some of the fronds are like the ordinary fronds of the less divided forms of var. α; while in others the pinnæ are deeply pinnatifid, and again cut into oblong lobes. This is named "*plumosum* Axminster fertile;" but it is much less finely divided than the Todmorton form, and that called var. *dissectum* Wollaston.

In Orkney I found a small form, which I suppose would be called *molle* by those who retain this as a variety, in which a large portion of the sori were round and without indusium; but as these fronds were gathered in the end of July, the sori may have had an indusium when younger. A plant of this form which I brought home died, so I was unable to make further observations.

Var. β, when growing in exposed situations, is remarkable for its pinnæ being convex, the margins being reflexed, so that the pinnæ appear very narrow and disconnected; but a plant of this form under a foot high has developed in cultivation into a plant 3 feet high, with flat or nearly flat pinnules, and from having a pale green colour tinged with reddish-brown, it has become deep green. It has, however, retained the erect habit and narrower parallel-sided form of frond much more abrupt at the base than in var. α. Specimens similar to this garden form abound in woods. They have usually a long stout stipes, which is sometimes green, but perhaps more often dull vinous-red, which colour is continued through the rachis.

Var. γ should perhaps be regarded as a subspecies. I know it only from specimens and a living root sent me by Mr. H. C. Watson. It has more the aspect of var. β than of var. α, but has a still stouter and longer green stipes, with the scales more numerous, more persistent, and of a darker maroon colour than is usual in vars. α and β, and has a more rigid lamina, broader in proportion to its length, and tripinnate, with the ultimate segments linear-oblong, with two or three narrowly triangular teeth towards the apex. The dimensions of a well-developed specimen are stipes 2 feet, lamina 2 feet 6 inches by 1 foot; lowest pinnæ 5 to 5½ inches in length; the lamina broadest, about ⅓ of its length above the base, not beyond the middle, as in var. α. The spores have the yellow colour more tinged with brown, and a surface with more conspicuous and more numerous blunt tubercles than in vars. α and β. Mr. Watson considers this the Athyrium incisum of Newman, and it is very probable that Mr. Newman's description was taken from var. *Watsoni*; but he says the "geographical range" of his incisum is "general, it requires only damp vegetable soil, shade, and absence from molestation." I have therefore little doubt that under his incisum he included the large and more divided forms of vars. α and β. Mr. T. Moore's var. *incisum*, which he describes with "fronds drooping," must be a divided form of our var. α. Aspidium irriguum, Sm. Engl. Bot. No. 2199, and Engl. Fl. vol. iv. p. 296, found at Tunbridge Wells, is a young state of var. β.

Lady-fern.

SPECIES II.—**ATHYRIUM ALPESTRE.** *Milde.*

PLATES 1871, 1872.

Milde, Fil. Europ. p. 53.
Asplenium alpestre, *Mettenius* in Abh. Senkenb. Naturf. Gesellsch. 1859, p. 242.
Phegopteris alpestris, *Mettenius*, Fil. Hort. Soc. Lips. p. 83.
Polypodium alpestre, *Hoppe*. *Moore*, Nat. Print. Brit. Ferns, Vol. I. p. 76. *Hook. fil.* Stud. Fl. ed. ii. p. 498. *Hook. & Baker*, Syn. Fil. ed. ii. p. 311. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 974.
P. Rhæticum '*Pallas*,' *Fries*, Summ. Veg. Scand. p. 82. *Gren. & Godr.* Fl. de Fr. Vol. III. p. 628. (Non *Linn.* teste *Moore*.)
Aspidium alpestre, *Schkuhr*, Krypt. Gen. p. 58.
Aspidium Rhæticum, *Swartz*, Syn. Fil. p. 59.

Caudex rather stout, erect or oblique, closely covered by the bases of former fronds, dividing into several divisions or crowns, which remain closely packed together. Fronds several from each crown, arranged shuttlecock-fashion, dying in autumn. Stipes rather stout, thickened immediately above the base, nearly flat on the anterior face, variable in length, but usually short, rather thickly clothed at the base, and sparingly above, with broadly-ovate and triangular lanceolate, acuminate hyaline or very pale brown scales, intermingled with numerous minute hair-like ones, most of which are deciduous. Lamina suberect or ascending or spreading, narrowly elliptical-oblong or oblong, or strapshaped-lanceolate, more or less attenuated towards the base, bipinnate or subtripinnate; ultimate segments crenate or serrate or inciso-serrate. Ultimate veins running into the teeth. Sori distributed over the whole of the frond, except the base or the apex, placed on the first anterior branch of the vein running into the ultimate segments, or on several of the branches, circular. Indusium very minute, very finely lacerate, fugacious, often absent. Spores brown, tuberculate, with numerous small blunt unequal tubercles.

SUBSPECIES I.—Athyrium eu-alpestre.

PLATE 1870.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 84.
Pseudathyrium alpestre, *Newm.* Phyt. 1851, p. 370; and App. xix. and 1853, p. 974; and Hist. Brit. Ferns, ed. iii. p. 200.
Asplenium alpestre, *Rabenh.* l. c. No. 84.
Phegopteris alpestris, *J. Smith*, Hist. Fil. p. 33.
Polypodium alpestre, *Bab.* Man. Brit. Bot. ed. vii. p. 445.

Caudex stout, erect or oblique, closely covered by the bases of former fronds, dividing into several divisions or crowns, which remain closely packed together. Fronds several from each crown, arranged shuttlecock-fashion, dying in autumn. Stipes rather stout, straight, thickened immediately above the base, nearly flat on the anterior face rather short, one-sixth to one-fourth the length of the lamina, rather thickly clothed at the base and sparingly above with broadly-ovate and triangular-lanceolate acuminate very pale brown scales, intermingled with numerous hair-like ones, most of which are deciduous. Lamina suberect or ascending, elliptical-oblong or narrowly oblong, attenuated towards the base and apex, bipinnate or subtripinnate; lower pinnæ spreading, upper ones ascending, not more distant than the lower ones; pinnules or ultimate segments broadest at the base, crenate or crenate-serrate or inciso-crenate; lobes entire or toothed at the apex.

Ultimate veins running into the teeth. Sori distributed over the whole of the frond, except a few pairs of pinnæ towards the base, placed on the first anterior branch of the vein running into the pinnules or ultimate segments, or on several of the branches. Indusium very minute, very finely lacerate, fugacious, often absent. Spores brown, tuberculate, with numerous small blunt unequal tubercles.

Var. α. *genuinum.*

Frond narrowly oblong, sometimes strapshaped-oblong, subparallel-sided towards the middle; pinnæ acuminate; pinnules strapshaped-lanceolate or narrowly lanceolate, acute, separated, sometimes convex from the margins being reflexed.

Var. β. *obtusatum.*

Fronds oblong-elliptical, with the sides more or less curved outwards towards the middle; pinnæ tapering gradually towards the apex, but not acuminate; pinnules oval-oblong or oblong, approximate, obtuse, generally flat.

Amongst stones and on rocks in alpine districts, frequent on highland mountains above 1800 to 4000 feet. It occurs on all the high mountains of Perthshire; on the Clova Mountains, Forfarshire; and Braemar Mountains, Aberdeen; first found on mountains near Dalwhinnie and on Ben Alder, Inverness-shire, in 1841, by Mr. H. C. Watson. It is recorded also from the counties of Banff, Argyle, and Sutherland.

Var. α, judging from the specimens I have, appears much more frequent than var. β, which grows side by side with var. α. I have it from Lochnagar, Canlochan, Ben Hope, Ben Lawers, and the Clova Mountains.

Scotland. Perennial. Summer, Autumn.

Fronds 1 to 3 feet high, extremely similar to those of A. Filix-fœmina, var. α simulating A. Filix-fœmina var. *erectum*, and var. β A. Filix-fœmina *genuinum*, though the two forms of eu-alpestre are less distinct than the above-named vars. of Filix-fœmina: A. alpestre, var. α having the frond attenuated towards the base, and var. β having the frond narrower than in Filix-fœmina *genuinum*; but even in the barren state eu-alpestre may be distinguished by its stipes being scarcely channelled above (there the rachis is), and with much broader and paler scales, which are almost white and hyaline when the frond first begins to expand. The most striking difference, however, lies in the round sori, which arises from their shape not being modified by a firm and persistent indusium; the spores also are darker coloured and conspicuously tuberculate, in this respect very different from the yellow, nearly smooth, spores of A. Filix-fœmina vars. α and β; but in A. Filix-fœmina var. *Watsoni* the spores show some approximation towards those of A. eu-alpestre.

The great majority of botanists place the present plant in the genus Polypodium or in the genus Phegopteris when they separate the latter from the former. The late Mr. E. Newman founded the genus Pseudathyrium upon it, but I think there is no doubt that Milde is right in placing it in the genus Athyrium, with which it agrees in every character except in the round naked sori; but then in several abnormal forms of A. Filix-fœmina the sori are round and naked, or with an imperfectly developed indusium, and in some otherwise ordinary forms of the same Fern the indusium falls away early, and the sori become round. On the other hand, in the very early stages of A. alpestre a rudimentary indusium may be found at least occasionally. The disposition of the curved vascular bundles of the petiole is precisely similar in the two plants, as well as their mode of growth, vernation, and venation. I myself have doubts whether A. alpestre should not be considered as merely a subspecies of A. Filix-fœmina. (See Duval Juve in 'Annot. Fl. de Fr. et d'All.,' pub. par C. Billot, pp. 57 and 149 to 151.)

Alpine Lady-fern.

SUBSPECIES (?) II.—**Athyrium flexile.**

A. alpestre var. flexile, ***Milde,*** **Fil. Europ. p. 53.**

Pseudathyrium flexile, ***Newm.*** **Phyt. 1853, p. 974; and Hist. Brit. Ferns, ed. iii. p. 204.**

Phegopteris flexilis, ***J. Smith,*** **Hist. Fil. p. 233.**

Polypodium flexile, ***Moore,*** **Handb. Brit. Ferns, ed. ii. p. 225.** ***Bab.*** **Man. Brit. Bot. ed. vii. p. 445.**

P. alpestre, var. flexile, ***Moore,*** **Handb. Brit. Ferns, ed. iii. p. 59; and Nat. Print. Ferns, 8vo. ed. vol. i. p. 76.** ***Hook. & Baker,*** **Syn. Fil. ed. ii. p. 311.**

P. alpestre, β. pumile, ***Hook. & Arn.*** **Brit. Fl. ed. viii. p. 581; and** ***Hook. fil.*** **Stud. Fl ed. ii. p. 498.**

Caudex stout, erect or oblique, closely covered by the bases of former fronds, dividing into several divisions or crowns, which remain closely packed together. Fronds several from each crown arranged shuttlecock-fashion, dying in autumn. Stipes rather stout, bent backwards and thickened immediately above the base, nearly flat on the anterior face, very short, often reduced merely to the enlarged portion above the base, and rarely more than one-eighth the length of the lamina, rather thickly clothed throughout with ovate and lanceolate pale brown scales, intermingled with hair-like ones, most of which are deciduous. Lamina spreading or spreading-ascending, strapshaped lanceolate, more attenuated towards the apex than towards the base, bipinnate; lower pinnæ deflexed, upper ones spreading and more distant; pinnules narrowed at the base, inciso-serrate; lobes toothed at the apex; ultimate veins running into the teeth. Sori distributed over the basal half of the frond, the apex being destitute of them, placed on the first anterior branch of the veins running into the pinnules or on several of the branches. Indusium very minute, very finely lacerate, fugacious, but rarely absent when the fronds unfold. Spores brown, tuberculate, with rather numerous small blunt irregular tubercles.

Very rare and local. At the head of Glen Prosen, Clova, Forfarshire. Great Corrie on Ben Alder, Inverness-shire.

Scotland. Perennial. Summer, Autumn.

Fronds 3 to 12 inches long, with an extremely short stipes; in cultivation the stipes is often confined to the enlarged basal portion which remains attached to the caudex. Scales more numerous and more of them ovate-triangular than in A. eu-alpestre. Lamina narrower—in wild specimens from Ben Alder collected by Dr. Buchanan White, with lamina between 3 and 4 inches long, the breadth is from 1 to 1¼ inch at the broadest part, which is about one-third above the base. Pinnules narrowed towards the base, while in P. eu-alpestre they are broadest towards the base. The most remarkable feature in this Fern is that the sori appear not to be produced on the apical portion of the frond, they are most numerous in the basal third, and it is but rarely that any can be found in the apical third.

I have great hesitation in separating this as a subspecies from A. eu-alpestre, because the character of the basal part of the frond being soriferous and not the apex, is so unusual among Ferns, that it may be suspected to be an abnormal form or monstrosity, and as this I should have regarded it had Mr. Backhouse's original station in Glen Prosen been the only one in which it occurred. But the Ben Alder specimens are similar, and in cultivation the plant becomes even more dissimilar from A. eu-alpestre than the wild specimens. I have had cultivated plants from Glen Prosen, where I believe it is now almost extinct, from Mr. Backhouse, and from Ben Alder from Mr. A. Craig Christie and Dr. F. Buchanan White. Mr. A. C. Christie tells me that A. flexile fruits when only 3 inches long, and A. alpestre growing with it not under 9 or 10 inches.

Dr. F. Buchanan White, who is one of the few botanists who have published detailed descriptions of A. eu-alpestre and A. flexile, after having observed both forms in their native localities, says, in the 'Scottish Naturalist,' 1881, p. 45: "The general appearance and habit of *flexile* afford one of the best points of distinction. *Alpestre* has erect fronds with a general appearance, as is well known, very similar to that of *Athyrium Filix-fœmina*, for which indeed it was long mistaken. *Flexile* on the other hand, has somewhat narrower and more tapering fronds, with the stipes bent or elbowed a little above its attachment to the rachis (caudex? Ed.), and in consequence the frond is far from erect, and, in fact in many cases is nearly parallel to the surface of the earth, which, with the deflexed pinnæ and the pinnules narrowed at the base, give a very distinct appearance. In addition, it is almost invariably smaller than *alpestre*—generally very much smaller—and, though the name implies a more pliant structure than *alpestre*, I think in reality it is more rigid."

Flexile Lady-fern.

GENUS XIII.—**ASPLENIUM.** *Linn.*

Fronds produced from the apex of the caudex, usually approximated, rarely solitary, often coriaceous or subcoriaceous, varying from simple to decompound, not densely scaly beneath. Stipes not articulated to the caudex, containing 1 or 2 vascular bundles which unite upwards, and give a 3- or 4-lobed section in the centre of the stipes. Veins simple or forked, free. Scales composed of short cells, with their boundaries greatly thickened, and of a much deeper brownish-red colour than the rest of the cell. Sori oblong or linear, straight or slightly curved, attached along the side of the veins. Indusium attached along the vein, of the same shape as the sorus.

Name from *α* (a) without, and *σπλήν* (splen) the spleen, which like the English name (Spleenwort), indicates the belief formerly entertained that the plant was a remedy for disorders of the spleen.

SPECIES I.—**ASPLENIUM FONTANUM.** *Bernh.*

PLATE 1872.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 33.
A. Halleri, *Spreng.* *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 982. *Gren.* & *Godr.* Fl. de Fr. vol. iii. p. 635. *Rabenh.* l. c.
Athyrium fontanum and A. Halleri, *Roth*, Fl. Germ. vol. iii. pp. 59 and 60.
Aspidium fontanum, *Swartz.* *Sm.* Eng. Bot. No. 2024.
Polypodium fontanum, *Linn.* Spec. Plant. p. 1550.

Caudex short, dividing into several scaly crowns; scales strap-shaped-triangular, entire, very acute. Fronds several from each crown, ascending or spreading. Stipes wiry, much shorter than the lamina, purplish-brown at the base, green at the upper part, margin with a few linear-triangular dark brown quickly deciduous scales. Lamina firm but not coriaceous, glabrous, dim, evergreen, strapshaped-oblanceolate or strapshaped-elliptical, longly tapering towards the base, and acuminate at the apex, bipinnate or subbipinnate; lowest pair of pinnæ very minute and smaller than the succeeding pair, deltoid-ovate, pinnate or pinnatipartite, more or less deflexed, the middle ones triangular-ovate or oblong, spreading; basal pinnules roundish, narrowed at the base, somewhat palmately inciso-serrate, with mucronate teeth. Rachis green, usually glabrous, margined, winged; partial rachides broadly winged so as to connect the bases of the pinnules. Pinnules with a flexuous mid-vein which gives off simple branches running to the teeth. Sori shortly oblong, often slightly curved, attached to the ultimate veins nearer to the midrib of the pinnules than to their margin, often ultimately confluent. Indusium entire or nearly so. Spores brown, muricato-tuberculate, with short rather large pointed tubercles.

On rocks and walls. A very doubtful native. On a garden wall at Ashfield Lodge near Petersfield, Hants, Rev. W. H. Hawker; on an old garden wall at Furze Down, Tooting, Surrey (station now destroyed), 1845, Mr. Gibbs; formerly on Amersham Church, Berks, found by Mr. Bradney according to Hudson; at "Swanage Cove, near Tillevilly, Isle of Purbeck, Dorset, and between Lang-Vwlch and Tremaddock," 1852, Dr. Power, Moore; near Matlock, Derbyshire, Mr. H. Shepherd; rocks in Wharncliffe Wood, Yorkshire, 1838, Mr. R. M. Redhead; Northumberland, Mr. J. Backhouse, Bab. Man., but not included in Baker's 'Flora of Northumberland and Durham,' 1868; rocks near Alnwick Castle, T. Moore; "Mr. Hudson gathered the same plant in a stony situation near Wybourn in Westmoreland, or rather, perhaps, Wiborne in Cumberland," Smith. "We have also been informed by Mr. D. Hutchison, formerly gardener at Bexley Abbey, Kent, that he has himself gathered this species in 1842, on moist rocks near the sea, a short distance north-east of Stonehaven, Kincardineshire, in a spot that has since been disturbed by the formation of the Aberdeen railway, so that in 1849 he was not successful in refinding it." (Moore, Nat. Print. Brit. Ferns, 8vo ed. vol. ii. 1863.) "Mr. W. O. Needham of Farnham, gave me the enclosed specimen of Asplenium fontanum, which he informs me were gathered by himself on the Cave Hill near Belfast, Co. Antrim, Ireland." (Edward Newman on label of specimen purchased at sale of collection of Botanical Society of London.) Not included in the 'Cybele Hibernica.'

England? Scotland? Ireland? Perennial. Summer, Autumn.

Stipes ⅙ to ½ the length of the lamina. Lamina 2½ inches long by ⅚ inch wide, to 9 inches long by 1¼ inch wide, decreasing gradually towards the base as in Athyrium Filix-fœmina, var. *genuinum* and Lastrea Oreopteris, a character which distinguishes it from all the other British species of Asplenium. The texture of the fronds though firm, is not coriaceous, they are of a bright deep-green colour, and not shining.

Koch makes two varieties of this plant, viz. α. *pedicularifolium*, and β. *angustatum*. The latter differs merely in its smaller size and less divided pinnæ, which are scarcely again pinnate. These varieties seem mainly to be dependent on situation, which causes one form to be more luxuriant than the other.

Smooth Rock Spleenwort.

SPECIES II.—ASPLENIUM LANCEOLATUM. *Huds.*

PLATE 1873.

***Rabenh.* Crypt. Vasc. Europ. Exsicc. Nos. 113 and 114.**

Caudex short, dividing into several scaly crowns; scales subulate, dentate, with setaceous points. Fronds several from each crown, ascending or spreading or pendent. Stipes wiry, shorter than the lamina, purplish-brown throughout, or rarely green in the upper part, faintly channelled above, with a few scattered hair-like dark-brown scales. Lamina firm but not coriaceous, glabrous, dim, evergreen, lanceolate or strapshaped-lanceolate, more rarely strapshaped, scarcely attenuated towards the abrupt base, acuminate towards the apex, bipinnate or rarely only once pinnate; lowest pair of pinnæ a little smaller than the succeeding pair, oblong or oblong-triangular, subsessile or very shortly stalked, spreading or occasionally deflexed; middle pinnæ similar to the basal ones, but usually a little longer; pinnules or ultimate segments obovate or oblanceolate or ovate-rhombic, wedgeshaped at the base, dentate or crenate-dentate, with mucronate teeth towards the apex, the larger ones often inciso-pinnatifid. Rachis mostly purplish at the base, especially on the underside, green on the upper part, margined, with hair-like scales; partial rachides narrowly winged, sometimes often connecting the bases of the pinnules. Pinnules with a flexuous mid-vein which gives off forked or simple branches running to the teeth. Sori shortly oblong, straight, attached to the ultimate veins, nearer to the margin of the pinnules than to the midrib. Indusium entire. Spores brown, muricate-tuberculate, with rather large pointed tubercles.

Var. *α. genuinum.*

Fronds bipinnate, or when small pinnate; pinnæ pinnatipartite or pinnatifid, acute or subacute; pinnules or ultimate segments obovate or oblanceolate or rhombic-ovate, with large acuminate mucronate teeth, which are as long as, or longer than broad.

Var. *β. obovatum.* Gren. and Godr.

A. obovatum, *Viviani.* *Guss.* Fl. Sic. Syn. p. 662.

Fronds pinnate; pinnæ pinnatipartite or pinnatifid, more rarely again pinnate, obtuse; ultimate segments large, roundish-obovate, with large rounded apiculate or shortly mucronate teeth, which are not so long as broad.

Var. *γ. microdon.* Moore.

A. marinum var. microdon, *Moore,* Ferns of Great Brit. Nat. Print. folio ed. sub tab. 38.

"Frond pinnate; pinnæ undulated, with apiculate-dentate margins, the lower ones distinct, obtuse, obliquely triangular, or unequally cordate-subhastate, lobate below; upper ones narrower, confluent. Sori short." (Moore, Handb. Brit. Ferns, 8vo. ed. vol. ii. p. 67.)

On ledges of rock, and walls and banks. Local. Frequent in Devon, Cornwall, and Somerset; it also occurs at Tunbridge Wells, on both the Sussex and Kent side of the stream which divides these counties, near the high rocks, and also on rocks in Eridge Park, Sussex; at Frenchey, Beechly, and near Stapleton, Gloucestershire; and in the counties of Pembroke, Glamorgan, Merioneth, Denbigh, Carnarvon. Very rare in Ireland; on both sides of the town of Kinsale, Cork, Mr. I. Carroll, from whom I have specimens, and on an old tower at Reencahirne, and on Ballycarbery Castle, near Cahirciveen, Rev. S. Madden, Sup. 'Cyb. Hib.' Of var. *β* I have specimens from Mr. I. W. N. Keys, from rocks near Tavistock, Devon, which I cannot distinguish from the ordinary Asplenium obovatum of the Mediterranean district.

"Var. microdon is a native of Guernsey, and was found in 1855 first by Miss Wilkinson, and subsequently in other stations by Miss Mansell, of the Quesne, and Mr. C. Jackson, to the latter of whom we are indebted for specimens and for our knowledge of the plant. Mr. Jackson informs us that it grows on banks of rough masonry without mortar, and intermixed with Asplenium lanceolatum, at some distance from the sea. It has been found within a short distance of Penzance by Mr. J. Mager, and this plant, which is somewhat more divided than the Guernsey form, proves incontestably its relationship to the species to which we refer it." (Moore, l. c. p. 73.)

England, Ireland. Perennial. Summer, Autumn.

Caudex with the crowns closely packed together, clothed with long linear-subulate and filiform dentate scales, which appear to be dark brown, but, when examined under a lens, are seen to be white and hyaline, with a network formed by thick reddish-brown longitudinal and transverse bars, which are the boundaries between the cells; the partitions project at the margins of the scales in the form of very minute teeth: these scales are good examples of the clathrate scales which distinguish the genus Asplenium from Athyrium. The stipes is shining, purplish-brown, thickly clothed with articulated hair-like scales when unfolding, but ultimately nearly glabrous, variable in length even in the same tuft, very rarely as long as the lamina, and usually only one-third or one-fourth as long, containing two oval vascular bundles. Lamina variable in size, but generally under 6 inches long by 1½ inch broad. The largest I have is 9 inches long by 3½ broad, with a stipes of 9 inches long; it was collected in a well in Jersey by Dr. J. A. Power. The fronds are of a deep bright green, without any lustre, and are evergreen if protected from frost, to which they are, however, very susceptible; so that the plant cannot be cultivated out of doors, at least in the greater part of Britain. The fronds vary in thickness, and are sometimes translucent, but more generally they are opaque, and, when growing in exposed situations, frequently have the pinnules recurved.

Var. β seems to pass insensibly into the typical form.

Var. γ I have never seen, but, judging from the impression in Moore's 'Nature-printed Ferns,' it is a most extraordinary variety. simulating Asplenium marinum.

Lanceolate Spleenwort.

SPECIES III.—ASPLENIUM ADIANTUM-NIGRUM.

Linn.

PLATES 1874 AND 1875.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 35, 36, and 115.

Caudex short, divided into several scaly crowns; scales linear-subulate, entire, tapering into long setaceous points. Fronds several from each crown, ascending or spreading or pendent. Stipes wiry, generally as long as and sometimes longer than the lamina, purplish-brown throughout, or rarely green in the upper part, channelled above, with a few scattered hair-like deciduous dark-brown scales. Lamina coriaceous or subcoriaceous, glabrous, usually shining, evergreen, triangular-lanceolate or triangular-oblong or triangular or deltoid-ovate, not attenuated towards the abrupt base, bipinnate or tripinnate, more rarely quadripinnate; lowest pair of pinnæ larger than the succeeding pair, ovate or lanceolate, conspicuously stalked, ascending-spreading or ascending straight or curved upwards; middle pinnæ similar to the basal ones, but smaller and usually less divided; pinnules or ultimate segments oblanceolate or ovate or rhombic-elliptical or strapshaped, serrate or crenate-serrate at least towards the apex; teeth acute, sometimes shortly mucronate. Rachis usually purplish-brown in the lower part, green in the upper part, margined; glabrous partial rachides narrowly winged, with the wing connecting the bases of the pinnules. Pinnules with a flexuous mid-vein which gives off forked or simple branches, running into the teeth. Sori linear-oblong or strapshaped, straight, attached to the ultimate veins, much nearer the midrib of the pinnules or ultimate segments than to their margins, often ultimately confluent. Indusium entire. Spores muricate-tuberculate, with rather large pointed tubercles.

Var. α. *genuinum.*

PLATE 1874.

Stipes usually as long as the lamina, and frequently exceeding it. Lamina coriaceous, opaque, shining with a greasy lustre, triangular-lanceolate, shortly acuminate, bipinnate or subtripinnate; lower pinnæ ascending, nearly straight; all the pinnæ acute or shortly acuminate; basal pinnules of the lower pinnæ not contiguous, lanceolate or rhombic-lanceolate, pinnate or pinnatipartite or pinnatifid, subobtuse or subacute; ultimate pinnules or segments ascending, subacute, toothed towards the apex; teeth longer than broad, gradually acute.

Var. β. *obtusum.* Kit. and Milde.

Var. obtusatum, *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 76. *Rabenh.* l. c. No. 36.
A. obtusum, *Kit.* in Herb. *Willd.* No. 19,927 (teste *Mild.*). Non *Presl.*

Stipes usually shorter than the lamina, and rarely exceeding it. Lamina coriaceous, opaque, shining with a greasy lustre, triangular-ovate, more rarely lanceolate-ovate, acuminate bipinnate or (rarely) subtripinnate; pinnæ spreading or spreading-ascending, straight; all the pinnæ obtuse or subobtuse, very rarely acuminated; basal pinnules of the lower pinnæ contiguous obovate or ovate or rhombic-ovate, lobed or incised or pinnatipartite; ultimate segments ascending, obtuse or crenate-serrate or dentate serrate towards the apex; teeth often no longer than broad, subacute, very shortly acuminate and subacute or very shortly mucronate.

Var. γ. *Serpentini.* Koch.

A. Adiantum-nigrum, var. obtusum, *Moore* in Journ. Bot. 1864, p. 129. *Hook. fil.* Stud. Fl. ed. ii. p. 493; *Hook. & Bak.* Syn. Fil. ed. ii. p. 214.
A. Serpentini, *Tausch.* Fl. 1839, p. 477. *Milde*, Fil. Europ. p. 86. *Rabenh.* l. c. No. 115.
A. obtusum, *Presl*, non *Kit.* (teste *Milde*).

Stipes as long as the lamina, or often exceeding it, more conspicuously margined than in vars. α, β, and γ. Lamina coriaceous or subcoriaceous, opaque, scarcely shining but with a faint satiny lustre, ovate-triangular or triangular, gradually acute, tripinnate or subquadripinnate; lower pinnæ ascending-spreading or spreading, straight, rarely slightly curved towards the apex of the frond, subacute, very rarely acuminated; basal pinnules of the lower pinnæ separated, rhombic deltoid, pinnate or subbipinnate; ultimate pinnules or segments ascending-spreading, wedgeshaped at the base, obtuse or subobtuse and crenate-dentate at the apex, with the teeth as long as or longer than broad.

Var. (?) γ. *acutum.* Pollini.

PLATE 1875.

A. Onopteris, var. α. acutum, *Milde*, Fil. Europ. p. 87.
A. Adiantum-nigrum, var. Virgilii, *Heufler*, *Willk. & Lange*, Prod. Fl. Hisp. Vol. I. p. 7.
A. acutum, "Bory, MS." *Willd.* Spec. Plant. Vol. V. p. 347. *Newm.* Hist. Brit. Ferns, ed. iii. p. 230.
A. Virgilii, *Guss.* Fl. Sic. Syn. p. 662.
A. productum, *Lowe*, Trans. Camb. Phil. Soc. 1838, p. 524.

Stipes generally much exceeding the lamina. Lamina subcoriaceous, translucent, faintly shining with a strong satiny lustre, ovate-triangular, longly acuminate, almost cordate, mostly tripinnate or subquadripinnate; lower pinnæ spreading-ascending at the base, and then curved upwards towards the apex of the frond, acuminate and very acute or subacute; basal pinnules of the lower pinnæ much separated, narrowly rhombic or rhombic-triangular, pinnate or subbipinnate; ultimate pinnules or segments ascending-erect, longly wedgeshaped at the base, very acute, serrate, with mucronate teeth longer than broad.

On rocks, walls, and banks. Vars. α and β not very abundant, but generally distributed, extending north to Orkney and Shetland. Frequent throughout Ireland.

Var. γ. *Serpentini*, on serpentine rocks, at Cabrach, in Aberdeenshire, on the confines of Banffshire, where it was discovered by the Rev. Andrew Christie. To this var. I am inclined to refer also a plant sent me by Mr. G. H. Kinahan, labelled "On serpentine a little south-west of Glendalough Hotel, Connemara."

Var. γ. *acutum* appears to be confined to the south-west of Ireland. I have specimens from Glen Carragh, Mr. G. Maw; Killarney, Mr. E. T. Bennett; and Bandon Hill, near Peafield, Rev. J. Allen. Mr. G. H. Kinahan writes to me that it is frequent in Connemara, Galway, and S.W. Mayo, but I have not seen specimens. Mr. H. C. Watson reports it from Surrey, and Dr. Lowe from Norfolk. Besides these localities it is reported from Jersey; from Combe Royal, south Devon; and the walls of the cathedral of St. Asaph, Wales; but as I have not seen specimens from these places, I do not know if they belong to *acutum*, as I understand it, or are merely finely divided states of var. α.

England, Scotland, Ireland. Perennial. Summer, Autumn.

A very variable plant, which Milde and others divide into 3 subspecies, and certainly taking the typical forms of each of these one is much inclined to endorse their opinion; but these principal forms are so intimately connected by intermediates, and the characters become so crossed, that I have found myself compelled to agree with those writers who regard them all as forms of one species. It is not, as in the case of the Lastreas, that we have distinct forms of which there are abundant individuals connected by intermediate forms of which there are few individuals: the types of the distinct forms of Lastrea are abundant, the intermediates scarce, and each intermediate form occurs only where the two typical forms which it connects grow together.

Very different from this is the case of Asplenium Adiantum-nigrum, in which there are far more individuals of the connecting forms than of the type-forms of two out of the three possible subspecies, at least in Britain and central Europe; while in the south of Europe and the Canary Isles another type-form becomes prevalent, and the intermediates which connect it with the form most common in Britain are more abundant than the northern form.

The first of Milde's subspecies "nigrum," Heufler, contains the forms here called *genuinum* and *obtusatum*. It is the least divided of the three, and has usually the stipes not exceeding the lamina, which is usually about 6 or 8 inches long, by 2 to 3 inches across the broadest part at the base; the frond is coriaceous and opaque with a greasy lustre, the ultimate segments are convex on the outer side. Milde's var. *obtusatum* is a less developed form, with the stipes usually shorter in proportion to the frond, which is rarely above 4 inches in length, and sometimes as little as 2 inches; it is less divided, and sometimes scarcely bipinnate; the ultimate segments are rounder and more obtuse than in var. *genuinum*, into which it passes insensibly, and is scarcely worthy of the name of a variety. Milde gives as one of the characters of his first form that there is only a solitary vascular bundle in the stipes, while in the second subspecies there are 1 or 2 bundles, and in the third two. I fear little reliance can be placed upon this character; in all the specimens I have examined there are two vascular bundles in the stipes where it starts from the caudex. These two bundles approach each other and coalesce before reaching the lamina. In small specimens the coalescence occurs much nearer the base than in large ones, but the point at which it does occur appears to depend on the degree to which the stipes is developed. Speaking of the petiole of Asplenium Adiantum-nigrum, Mons. Duval Jouve says: "A leur base dilatée ils présentent de chaque côté et presque contre la périphérie un faisceau fibro-vasculaire simple, dont la coupe est réniforme oblique; plus haut, ces deux faisceaux se rapprochent vers le centre sans jamais se fondre en un seul" (Billot, Annot. Fl. de Fr. et d'All.' p. 247). My experience is contrary to this, as I find the two bundles always ultimately coalesce, and sometimes indeed very near the base; so I suspect the unity or duality of the vascular bundles varies in different specimens.

The second subspecies, "Serpentini," Tausch., appears to be confined to serpentine rocks in Saxony and Silesia, south to Italy, Dalmatia, and Hungary. It was first recorded as a British plant by Mr. T. Moore, from specimens collected by the Rev. A. Christie, on serpentine rocks at Cabrach, Aberdeenshire. It differs from the commoner form of Adiantum-nigrum by its lamina being more divided, and the ultimate segments less approximate, and more or less bent away from the partial rachis. The frond also is dim, without the greasy lustre of the common form, or the satiny lustre of the form *acutum*. Milde says concerning it, that he has often found fronds passing into A. Adiantum-nigrum on the same rhizome with A. Serpentini. The stipes is usually longer than the frond, often conspicuously so. The lamina is from 4 to 6 inches long in the specimens I have seen. Milde says the fronds do not last through the winter, but in answer to a query of mine on this point, Mr. Christie writes that the fronds are evergreen at Cabrach. Along with the true Serpentini there grows a form connecting it with ordinary Adiantum-nigrum.

Mr. Christie says that the stipes varies considerably in length. "In the specimens sent, those in which it is long were taken out of chinks in the rock, and therefore lengthened to bring the fronds towards the light; those in which the stipes is short were growing in an open situation."

The third subspecies admitted by Milde, "Onopteris," which contains the var. "*acutum*," is frequent in the Mediterranean region, Madeira, and the Canary Isles. I have not seen it in this country except from the south of Ireland, and Mr. T. Moore also has seen true examples of this variety only from Ireland, though it is closely approached by English forms, and also by one which Mr. Moore calls "*oxyphyllum*," gathered near Dunoon and near Stirling, but which I have not seen. I am indebted to Mr. J. F. Duthie for living plants of genuine *acutum* from the neighbourhood of Florence. It differs conspicuously from the ordinary Adiantum-nigrum in the texture of its fronds, which are not thick, cartilaginous and opaque, as in the common form, and have a satiny, not a greasy lustre; this apparently arises from the epidermal cells being narrower in *acutum* than in A. Adiantum-nigrum, at least this is the case with Mr. Duthie's plants, but unfortunately this character is in a great measure lost in dried specimens, which can be distinguished only by the longer stipes, the deltoid-ovate outline of the more divided frond with narrow and elongated ultimate segments. It appears to attain a larger size than the other forms. The largest Irish specimen I possess has a stipes 8 inches long, and a lamina of 5½ by 3 inches at the broadest part; but a specimen from Naples has it 10½ inches long by 7 inches broad, and Teneriffe specimens are quite as large. Mr. Moore has an Irish specimen with the lamina of the frond 9 inches long and 7 inches broad.

Mr. Kinahan, of the Geological Survey of Ireland, has supplied me with some notes on the Irish forms of Adiantum-nigrum. "In north-west Galway and south-west Mayo the A. Adiantum-nigrum seems to grow as follows. It is always associated with more or less calcareous rocks, which may be shales, limestones, dolomites, serpentines, and the other associated pseudomorphic rocks. In exposed sunny situations it is always diminutive (the obtusum of some authors). This variety is not, however, very common. The most usual form is like No. 1,* but the more shady the nook, and the more northern the aspect, the more acute the form. The typical form of acutum always grows in cliffs and caves facing the north and north-east. The general character of its stipes is long, as when the plant grows in a crevice the plant wants to get above the fissure, but it depends altogether upon the situation. The best fronds usually have a long stipes. I believe there is only one species that will change according to the place it grows in. Acutum does not necessarily grow in woods, but the most typical plants that I ever saw were in a cliff with a northern aspect, in the wood north of Lady Kinnear's cottage on the Lakes of Killarney. When I first saw it the trees had been cut away from it, having the cliff quite covered with such a marked variety of the fern that I firmly believed it must be a distinct species. Five or six years afterwards I visited the place, and found the trees amazingly grown, and that only in the still exposed places grew the A. acutum, while in the places shaded by the trees it was replaced by the normal form." It seems curious that increased shade should cause the acutum to pass into the normal form; I should have expected the reverse to happen.

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* Typical Adiantum-nigrum.—Ed.

A. Adiantum-nigrum can scarcely be confounded with any other British fern, except perhaps A. lanceolatum, from which it differs in its fronds being much thicker and firmer in texture, and with the lower pinnæ much larger, so that the frond is triangular or even subdeltoid rather than lanceolate. The sori are much longer and more remote from the margin of the pinnules and segments than in A. lanceolatum, and the scales at the base of the stipes are longer and more attenuated, generally with only a single longitudinal rib of thickened tissue towards the apex.

Black Spleenwort.

SPECIES IV.—**ASPLENIUM MARINUM.** *Linn.*

PLATE 1876.

Caudex short, tufted, divided into several scaly crowns; scales linear-lanceolate, entire, tapering into long setaceous points. Fronds several from each crown, spreading or pendent. Stipes rather slender but not wiry, from one quarter to as long as the lamina, purplish-brown, margined with green in the upper part, with a few scattered hair-like deciduous dark-brown scales. Lamina thick, coriaceous, glabrous, shining, evergreen, strapshaped or oblong-strapshaped or triangular-strapshaped, abrupt or tapering towards the base, and always tapering towards the apex, pinnate; lowest pair of pinnæ smaller than or equalling the succeeding pair, very shortly stalked or subsessile, decurrent, spreading or ascending-spreading, rhomboidal-ovate or rhomboidal-oblong or rhomboidal-strapshaped or trapezoidal-rhombic or strapshaped-triangular, entire and rectangular or inversely-deltoid or wedgeshaped at the base (which is usually unequal-sided), obtuse or acute, crenate or crenate-serrate or slightly lobed, more rarely serrate or incised; middle pinnæ similar to the basal ones, and equalling them, but sometimes a little larger; all decurrent; terminal pinnæ smaller and confluent. Rachis more or less brown, at least towards the base, margined with narrow green wings, glabrous. Pinnæ with a flexuous mid-vein, giving off forked branches running into but not reaching the crenatures. Sori linear or strapshaped or oblong, mostly attached to the anterior fork of the venule, usually commencing at the margin, and not unfrequently extending nearly to the midrib, but variable in position with regard to both, rarely confluent. Indusium entire. Spores tuberculated, with numerous blunt rounded tubercles.

Var. α. *genuinum.*

Pinnæ rhomboidal-oblong or rhomboid-oval, obtuse.

Var. β. *acutum.* Moore.

Pinnæ oblong-triangular or strapshaped-triangular or linear-triangular, acute.

In the crevices of rocks and in caves, near the sea. Frequent in the south and west, from Sussex to Orkney and Shetland; rarer on the east coast, though occurring in a few stations from York northwards. Frequent in Ireland. Rare inland, though it has occurred near Warrington and Newton, Lancashire, and at the Lakes of Killarney, co. Kerry. Var. β occurs in Cornwall and Devonshire, and in the Channel Islands, along with the commoner form.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant growing in dense tufts, which take their shape from the fissures of the rock on which it grows. Crowns thickly clothed with purplish-brown scales, in which there are many longitudinal thickened bars. Stipes varying much in length even in the fronds from the same tuft, thicker and more brittle than in the preceding species. Var. α has the stipes $2\frac{1}{2}$ to 5 inches long. Lamina $1\frac{1}{4}$ to 8 inches long, and $\frac{3}{4}$ to 2 inches broad; pinnæ usually close together, more developed at the base on the anterior than on the posterior side, and with the anterior portion of the base usually parallel with the rachis, thick and fleshy in texture, and deep glossy green in colour. Sori when long, generally with their ends equally near the margin and midrib, but when they are abbreviated they are sometimes near the midrib and sometimes near the margin, generally speaking they remain distinct, but occasionally, or in small specimens, they become confluent.

Var. β is a larger plant, with the pinnæ rounder and more pointed, the venules making a more acute angle with the mid-vein than in var. α. I have specimens from Plymouth Hoe with stipes 9 inches long, and the lamina about a foot long by 4 inches broad, and Mr. T. Moore records specimens of *parallelum* (which is here included under var. β) "from Guernsey, gathered by Mons. Boistel, measuring 34 inches in length, of which 24 inches were occupied by about 30 pairs of pinnæ, the largest being about 2½ inches long and ⅜ inch wide; larger specimens were produced on the same plant, which was growing in the same soil, but on a damp rock." Moore, Nat. Print. Brit. Ferns, 8vo ed. vol. ii. p. 93.

Although the extreme forms of vars. α and β are much unlike, they are so connected by intermediate forms, that they scarcely deserve to be separated even as varieties; the shape of the base of the pinnæ, or the degree to which their margins are crenate, serrate, or lobed, are too variable to be sufficient to separate the various forms, as even in fronds on the same tuft they often vary to a considerable extent.

This cannot well be confounded with any other British Fern. The only one which looks at all like it is Asplenium lanceolatum, var. *microdon*, but from it A. marinum differs by its larger scales, thicker stipes, much more coriaceous or cartilaginous lamina, glabrous rachis, and elongated generally median sori. The fronds present sometimes a slight resemblance to those of Polypodium vulgare, but in that the pinnæ are adnate to the rachis by their whole base, while in A. marinum not even the lower ones are connected by their whole base, and it is almost needless to remark that the difference in their generic characters will prevent their being mistaken the one for the other.

Sea Spleenwort.

SPECIES V.—ASPLENIUM VIRIDE. *Huds.*

PLATE 1877.

Rabenh. **Crypt. Vasc. Europ. Exsicc. No. 34.**

Caudex rather elongated and creeping, divided into several sparsely scaly crowns or shortly creeping branches; scales linear-lanceolate, denticulate in the lower portion, tapering into short setaceous points, usually concolorous. Fronds several from each crown, spreading or ascending. Stipes slender, not wiry, from one-eighth to nearly half the length of the lamina, purplish-brown at the base, green above, with scattered hair-like deciduous brown scales. Lamina thin, flaccid, translucent, glabrous, dim, evergreen, linear or more rarely elliptical-linear, tapering slightly at the base and apex, pinnate; lowest pair of pinnæ smaller than or equalling the succeeding pair, very shortly stalked or subsessile, spreading, rhombic-ovate or ovate or rhombic-suborbicular or deltoid-ovate, entire and truncate or inversely deltoid at the base (which is commonly equal-sided), obtuse, crenate or inciso-crenate; middle pinnæ similar to the basal ones, and generally longer and narrower and more trapezoidal; terminal pinnæ smaller; all distinct, or two or three of them confluent with the terminal lobe of the frond, persistent and withering while attached to the rachis. Rachis green, furrowed above, not winged, with a few scale-like hairs, ultimately glabrous. Pinnæ with an indistinct flexuous mid-vein, giving off simple or once-forked branches running to the crenatures and nearly reaching the margin. Sori oblong, attached to the lower part of the ultimate veins, and extending below their forks, nearer the midrib than the margin of the pinnæ, ultimately confluent. Indusium finely denticulate or crenate, rarely entire. Spores tuberculated, with numerous subacute tubercles.

On rocks in mountainous districts, from South Wales and Derbyshire, north to Sutherland and Shetland, but apparently wanting in Orkney. Common in the hilly parts of the north of England and the Highlands of Scotland. It grows also on walls, at low elevations at Danny (Sussex), Mickleham (Surrey), Hambridge (Worcester), and Linnmill (Clackmannan), but there is always a possibility that it may have been planted in such localities. In Ireland it occurs along the west, from Kerry to Donegal.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Caudex usually more elongated and creeping than in the other British Asplenia. Stipes from ¼ to 4 inches long or even more. Lamina from 1 inch long by ¼ inch broad to 5 inches long by ⅝ inch broad, of a pale delicate green colour and thin texture, resembling that of A. lanceolatum. Pinnæ generally separated, but in small specimens they are often contiguous, variable in shape; in large specimens they are usually very broad, truncate at the base, and more or less ovate-rhombic, while in small specimens they are more often wedgeshaped at the base, and longer than broad, always distinctly crenate, and sometimes doubly crenate; occasionally they are deeply incised, but these appear to be monstrous forms; sometimes the base is most developed on the anterior side of the mid-vein of the pinnæ, so that the form is more or less trapezoidal. The sori are very short and close to the midrib of the pinnæ.

A. viride can be mistaken for no other British fern, except A. Trichomanes; the differences between these two are pointed out under the latter species.

Green Spleenwort.

SPECIES VI.—ASPLENIUM TRICHOMANES. *Linn.*

PLATE 1878.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 25.

Caudex short, tufted, dividing into several scaly crowns; scales linear-lanceolate, entire, tapering into short setaceous points, usually with a dark central stripe. Fronds several from each crown, spreading or ascending. Stipes slender, wiry, usually very short, and hardly ever more than one-sixth the length of the lamina, purplish-brown throughout, with scattered hair-like deciduous brown scales. Lamina thick, coriaceous or subcoriaceous, opaque, glabrous above, but sometimes with a few deciduous gland-tipped hair-like scales beneath, dim, evergreen, linear or more rarely strapshaped-linear, tapering slightly towards the base and apex, pinnate; lowest pair of pinnæ smaller than the succeeding pair, subsessile, spreading, suborbicular or deltoid-suborbicular, truncate or inversely-deltoid at the base, obtuse, repand or crenate or rarely incised; middle pinnæ longer than the basal ones, roundish-oval oval or oblong, rarely oblong-strapshaped, truncate or inversely deltoid or wedgeshaped at the base; terminal pinnæ smaller; all distinct or two or three of them confluent with the terminal lobe of the frond, deciduous and falling off from the rachis when mature. Rachis purplish-brown with a narrow brown wing on each side, and having notches in which the pinnæ are inserted, at first with a few hair-like scales, ultimately glabrous. Pinnæ with a flexuous mid-vein, giving off once-forked branches running to the crenatures and nearly reaching the margin. Sori oblong-linear, attached to the anterior branch of the venules beyond their forks and equidistant from the midrib and the margins of the pinnæ, often ultimately confluent. Indusium entire or repand, rarely crenulated. Spores muricated, with numerous small acute tubercles.

Var. α. *genuinum.*

Middle pinnæ roundish-oval or oval-oblong, mostly equal at the base, repand or crenate. Rachis rounded beneath.

Var. β. *anceps.* Soland.

Lowe, Primit. Fl. et Faun. Madeir. p. 8.

Middle pinnæ oblong or oblong-strapshaped, auriculate above, crenate-serrate. Rachis more prominent beneath than in var. α.

On rocks and walls rather frequent. Generally distributed, extending to Orkney. Frequent but rather local in Ireland. Var. β. Hedge-bank near Bowler Green, south-west Surrey, H. C. Watson; "Killarney," Bab. Man. Brit. Bot. ed. vii. p. 452.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant growing in dense tufts. Fronds including the very short stipes, $1\frac{1}{2}$ to 1 foot long, by $\frac{1}{4}$ to $\frac{3}{4}$ inch broad. After the fall of the pinnæ, the stipes and bare rachis remain and in old plants each of the approximate crowns is surrounded by a guard of these leafless purplish-brown rachides.

Var. β. seems to pass insensibly into the ordinary form. Mr. T. Moore says of A. anceps that it has not, he believes, been found in Britain, but specimens from Mr. H. C. Watson, collected in Surrey, appear inseparable from the plant of the Atlantic islands; some of these specimens have fronds 10 inches long by $1\frac{1}{4}$ inch broad.

There are some very beautiful monstrosities of A. Adiantum-nigrum, of which the form called *incisum* by Moore is the most striking; in this the leaves are irregularly deeply pinnatifid, with the segments incised. It is, as Mr. Moore says, exactly analogous to the form *Cambricum* of Polypodium vulgare, and the fronds are said to be uniformly barren.

Crested forms in which the apex of the frond is spread out into a tassel are more common, and are said to be invariably produced from spores.

Asplenium Trichomanes is liable to be confounded with A. viride; but in that species the stipes is green at the apex, and the rachis wholly green and destitute of the raised brown wing down each side, the pinnæ are persistent and more evidently stalked, much thinner in texture and more translucent, so that the veins are readily seen when the plant is held up to the light, paler green, and usually more crenate, with the sori shorter and nearer the midrib. When A. Trichomanes becomes luxuriant the pinnæ are longer and narrower in proportion than in the smaller forms; while in A. viride they become broader and more rhombic or deltoid-rhombic.

Maidenhair Spleenwort.

SPECIES VII.—ASPLENIUM CLERMONTÆ.

PLATE 1879.

A. Petrarc[h]æ, *Newm.* Hist. Brit. Ferns, ed. v. p. 146; non *DC.*

"Caudex small, tufted; the crown covered with dark-coloured, linear, sharp-pointed scales." Newman. Stipes slender, wiry, shorter than the frond, chestnut-brown below, green in the upper part, with scattered hair-like brown scales. Lamina rather thick, subcoriaceous, opaque, glabrous, dim, evergreen, linear, abrupt at the base, tapering towards the apex, pinnate; lowest pair of pinnæ larger than the succeeding pair, shortly stalked, spreading, deltoid, three-lobed, lobes roundish-obovate, deeply crenate; middle pinnæ smaller than the basal ones, rhombic-ovate, inversely deltoid at the base, obtuse, crenate; terminal pinnæ smaller, oval-obovate, wedgeshaped at the base, obtuse, crenate or simply repand, several of them confluent with the terminal lobe of the frond, persistent. Rachis green, not winged, but with the stalk of the pinnæ very shortly decurrent, with a few hair-like gland-tipped scales. Lower pinnæ flabellately veined, with the veins forked; middle and upper pinnæ with a flexuous mid-vein giving off once-forked branches running to the crenatures, and nearly reaching the margin. Sori oblong-linear, attached to the anterior branch of the ultimate veins beyond their forks and equidistant from their base and the margins of the pinnæ, not confluent. Indusium denticulate.

Found by Lady Clermont, in 1863, growing on the back of a garden wall among Asplenium Trichomanes and Asplenium Ruta-muraria, at Ravensdale Park, Newry. Mr. Newman gives the station as "near Flurry Bridge," but I suppose the same place is intended.

Ireland (extinct). Perennial. Autumn.

Stipes about 1 inch long. Lamina 2 to 2½ inches long by ½ inch broad. Stalk of the pinnæ about $\frac{1}{20}$ inch long. Lowest pinnæ about ⅜ inch long, and nearly as broad at the base, with three lobes, of which the central one is the largest, each lobe with a nearly equal vein, which gives off forking branches, but these do not form mid-veins to the three divisions of the pinna; in the undivided pinnæ, however, there is a flexuous mid-vein like that of A. Trichomanes. The spores are immature in the specimen which I have seen, which I received through the kindness of Lord Clermont; they appear to be similar to those of A. Ruta-muraria, that is tuberculate with rather large blunt tubercles.

Distinguished from A. Trichomanes, of which the authors of the 'Cybele Hibernica' "suspect it will prove to be a form," by its stipes being green at the top and the rachis without the prominent dark wing which runs down each side of the upper face. The pinnæ also are distinctly though shortly stalked, and the lower ones three-lobed. The venation has also more tendency to be flabellate, and the indusium is conspicuously denticulate.

From the continental A. Petrarchæ, to which Mr. Newman refers it, it differs in not having the stipes wiry, and purplish-black throughout, the frond more tapering, the pinnæ persistent, the lower ones with longer stalks, more evidently three-lobed, and as large as or larger than the succeeding pair, the middle ones smaller and not pinnately-lobed; it also is not densely glandulose on the rachis, lamina, and indusium, and the latter is not entire but jagged at the edges, as in A. Petrarchæ, and the sori are longer and narrower.

From A. Ruta-muraria it differs in the frond being linear, only once pinnate, and in the pinnæ having much shorter stalks, with a more decided mid-vein, and the sori on the middle pinnæ diverge more from the median line of the pinnæ. The stipes, rachis, venation, sori, and indusia are, however, more like those of A. Ruta-muraria than of any other British Asplenium.

A. Clermontæ belongs to a group of forms intermediate between A. Trichomanes and other species of this genus, and which are generally believed to be hybrids. These have been found in very small quantity, often only single roots, where A. Trichomanes grows in company with those species between which and A. Trichomanes the forms to which I allude are intermediate. These are in the first place A. adulterinum, *Milde*, which has been found in Northern Bohemia and near Schönberg in Moravia; this is intermediate between A. Trichomanes and A. viride, and Milde considers it as certainly a hybrid.

The next is A. dolosum, *Milde*, of which a single caudex was found by Milde growing with A. Trichomanes and A. Adiantum-nigrum at Méran in the Southern Tyrol, and which he also believes to be a hybrid; I have not seen this form, but it evidently approaches A. Clermontæ very closely: it differs by having the stipes entirely and the rachis partly blackish, the pinnæ more deeply divided and with acute teeth, and the indusium quite entire.

The third form is A. Heufleri, *Reichardt*, which was found growing with A. Trichomanes and A. Germanicum between Vilpian and Mölten, in the Southern Tyrol, and at Eichorn, Moravia: this is quite intermediate between the two species with which it grows, and is considered by Milde to be a hybrid.

I have scarcely any doubt that A. Clermontæ is a hybrid between A. Trichomanes and A. Ruta-muraria, between which it is quite intermediate, and it ought to be looked for in other places where these two species grow together. The plant has been eradicated at Ravensdale Park, but it is quite possible it may survive in some fern-grower's collection. I have followed the example of Milde in giving a distinct name to this form.

It is but an inference that ferns do produce hybrids, as it has never been actually proved by experiment, but every new intermediate form which exists in extremely small quantity and is found in circumstances where the supposed parents grow together adds to the probability of hybridization in ferns. A. Clermontæ has a peculiar interest, as so many of the supposed hybrids cluster round A. Trichomanes.

Lady Clermont's Spleenwort.

SPECIES VIII.—ASPLENIUM RUTA-MURARIA. *Linn.*

PLATE 1880.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 37.
A. murale, *Bernh.* *Gray's* Nat. Arr. Brit. Pl. Vol. II. p. 14.
Tarachia Ruta-muraria, *Presl*, Epim. Bot. p. 81.
Amesium Ruta-muraria, *Newm.* Hist. Brit. Ferns, ed. ii. p. 10, and ed. iii. p. 254; and Phytol. 1851, App. viii.
Scolopendrium Ruta-muraria, *Roth*, Fl. Germ. Vol. III. p. 52.

Caudex short, divided into several closely-packed scaly crowns; scales linear-subulate, very acute. Fronds several from each crown, ascending or spreading or pendent. Stipes wiry, from as long as to twice as long as the lamina, purplish-brown for a very short distance from the base, green in the upper part, channelled above, with a few very narrow deciduous brown scales, and numerous very minute globose deciduous glands. Lamina thick, coriaceous or subcoriaceous, opaque, glabrous, shining, evergreen, triangular-ovate deltoid-ovate or triangular-lanceolate, rarely triangular-strapshaped, bipinnate or subtripinnate, or rarely simply pinnate, in the latter case the lower segments more or less deeply cut; lowest pinnæ larger and more divided than the succeeding ones, conspicuously stalked, ascending or spreading-ascending, pinnate or trifoliate or trifid; middle pinnæ similar to the basal ones, but smaller and more shortly stalked and less divided; all of them alternate; pinnules or ultimate segments obovate or rhombic oblanceolate, or rhombic-oblong or oblanceolate-strapshaped, inversely deltoid or wedgeshaped and entire at the base, obtuse or rounded, rarely acute, crenate or inciso-crenate or crenate-serrate at the apex. Rachis green, not winged. Ultimate segments flabellately veined, without a distinct mid-vein. Sori oblong or linear-oblong, usually diverging, situated about the middle of the pinnæ and not reaching its margin, ultimately confluent. Indusium dentate or fimbriate. Spores tuberculated, with rather large blunt tubercles.

Var. *α. genuinum.*

Lamina bipinnate, rarely only pinnate; ultimate segments obovate or rhombic.

Var. *β. elatum.* 'Lang,' Moore.

Frond bipinnate or almost tripinnate; ultimate segments oblanceolate or rhombic-oblong, narrowly wedgeshaped at the base, obtuse, more rarely truncate at the apex. Stipes longer and whole plant taller than in var. *α.*

Var. γ. *pseudo-Germanicum.* "Heufler," Milde.

A. Ruta-muraria, var. cuneatum, *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 124. Non A. cuneatum, *Lamarck.*

Frond bipinnate or scarcely more than pinnate, narrow; ultimate segments long, oblanceolate-strapshaped, very narrowly wedgeshaped at the base, truncate and toothed at the apex. Stipes usually longer in proportion to the lamina than in var. α.

On rocks and walls, common and generally distributed, extending to Orkney. Frequent throughout Ireland. Var. β, Derbyshire, Cumberland, and the south and west of Ireland, and probably elsewhere. Var. γ Pass of Llanberis, Carnarvon; and near Bristol. Stenton Rock, near Dunkeld, Perth. Var. *cristatum* seems to be a monstrous form of this, found near Tunbridge Wells (Kent); and Ruthin Castle (Denbighshire).

England, Scotland, Ireland. Perennial. Summer, Autumn.

Plant growing in very dense tufts. The stipes is very variable in length in proportion to the lamina, even in fronds from the same tuft. The scales are strongly clathrate, with the network very thick. The lamina is ¾ inch to 2½ inches by ½ to 1½ inch broad. The ultimate segments vary from ⅛ to ½ inch long in vars. α and β, but in var. γ they are ¾ inch long or even more.

In young plants the first fronds are entire and somewhat resemble one of the segments of the barren frond of Botrychium Lunaria: they are much thinner in texture than in the mature plant. These fronds are succeeded by trifoliate ones.

Dwarf forms are sometimes trifoliate or pinnate.

Var. γ is frequently little more than pinnate with the long ultimate segments connected at the base. It has sometimes been mistaken for A. Germanicum, which see.

Wall Rue.

SPECIES IX.—ASPLENIUM GERMANICUM. *Weiss.*

PLATE 1881.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 88.

A. alternifolium, *Wulf.* *Sm.* Eng. Bot. ed. i. No. 2258; and Eng. Fl. Vol. IV. p. 309.

A. Breynii, *Retz.* *Fries*, Summ. Veg. Scand. p. 82. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 983. *Gren. & Godr.* Fl. de France, Vol. III. p. 637.

Tarachia Germanica, *Presl*, Epim. Bot. p. 79.

Amesium Germanicum, *Newm.* Hist. Brit. Ferns, ed. ii. p. 10, and ed. iii. p. 258; and Phytol. 1851, App. p. vii.

Scolopendrium alternifolium, *Roth*, Fl. Germ. Vol. III. p. 53.

Caudex short, divided into several closely packed scaly crowns;

scales linear-subulate, very acute, with stalked glands. Fronds several from each crown, ascending. Stipes wiry, from as long as to twice as long as the lamina, purplish-brown for about half its length from the base, green in the upper half, channelled above, with a few very narrow deciduous brown scales, but no glands. Lamina rather thick, subcoriaceous, nearly opaque, glabrous, dim, evergreen, triangular-strapshaped or triangular-linear, pinnate; lowest pinnæ larger than the succeeding ones, rather shortly stalked, ascending, trifid or incised; middle pinnæ smaller and more shortly stalked than the basal ones, incised or undivided, curving inwards towards the rachis, narrowly wedgeshaped and entire at the base, oblanceolate or strap-shaped-oblanceolate at the apex only; uppermost pinnæ sessile, linear, entire or with one or two teeth at the tip, a few of the uppermost ones confluent with the terminal lobe of the frond. Rachis green, not winged. Pinnæ or ultimate segments flabellately veined, without a distinct mid-vein. Sori linear-oblong or linear, situated about the middle of the pinnæ, ultimately confluent. Indusium quite entire. Spores tuberculated, with rather large blunt tubercles.

On rocks. Local and very rare. Between Llanrwst and Capel Curig and Bwlch-y-Rhyn, Denbigh, and Moel Lechog, Carnarvon; Helvellyn and Borrowdale, Cumberland; Kyloe Crags, Northumberland. On the Tweed two miles from Kelso, and on Minto Crags, Roxburghshire; three miles from Dunfermline, Fife (now extinct according to Mr. C. Howie); Stenton Rock near Dunkeld, Perth. Reported also from Culborne, Somerset; from Arthur's Seat and Blackford Hill, Edinburgh; from near Perth, and from almost inaccessible rocks near Airlie Castle, Forfarshire.

England, Scotland. Perennial. Summer, Autumn.

Fronds 1 to 5 inches high, of which the stipes is generally the greater part. Lowest pinnæ $\frac{1}{8}$ to $\frac{1}{2}$ inch in length. A. Germanicum is liable to be confounded with elongated forms of A. Ruta-muraria, but the stipes is without glands, more wiry, and a much greater part of it is darker-coloured and very persistent, so that tufts of old plants remind one of those of A. Trichomanes. The frond is thinner, of a paler green; the pinnæ less divided, more shortly stalked, more incurved, shorter and more deeply crenate or serrate at the apex; the sori are longer, with the indusium quite entire; the spores are considerably smaller and with fewer tubercles than in any form of A. Ruta-muraria.

Bory considers this species a hybrid between A. Ruta-muraria and A. septentrionale, and Ascherson a hybrid between A. septentrionale and A. Trichomanes; Hüter, a hybrid between A. Ruta-muraria and A. Trichomanes; but there seems no ground for regarding the plant as anything but a true species. Although scarce in Britain, it is not so on the continent, and is found over the whole of Europe. According to Milde, it is common in Silesia and the Tyrol, and he has seen it in many places, not in company with A. septentrionale or A. Trichomanes or A. Ruta-muraria.

Alternate-leaved Spleenwort.

SPECIES X.—ASPLENIUM SEPTENTRIONALE. *Hull.*

PLATE 1882.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 61.
Acrostichum septentrionale, *Linn.* Spec. Plant. 1524.
Acropteris septentrionalis, *Link. Rabenh.* l. c. No. 61.
Amesium septentrionale, *Newm.* Hist. Brit. Ferns, ed. ii. p. 10, and ed. iii. p. 265; and Phyt. 1851, App. p. vii.
Scolopendrium septentrionale, *Roth*, Fl. Germ. Vol. III. p. 49.

Caudex short, divided into several closely packed scaly crowns; scales subulate, acute, entire or with stalked glands. Fronds several from each crown, ascending. Stipes wiry, longer than the lamina, generally twice or thrice and sometimes four times as long, purplish-brown for about $\frac{1}{4}$ of its length from the base, green in the upper half, channelled above, clothed with numerous cylindrical unicellular hairs, especially towards the base. Lamina very thick, coriaceous, opaque, dim, evergreen, wedgeshaped and once or twice forked or laciniate, or linear and undivided; segments linear or strapshaped-linear, tapering towards the base and apex, very narrowly wedge-shaped at the base, and very acute at the apex, entire or with one or two narrow ascending secondary segments, and usually with one or two long teeth at the apex. Rachis green, not winged. Segments and secondary segments without any mid-vein; veins few, forked, parallel. Sori linear, parallel, nearly covering the lower surface of the segments, ultimately confluent. Indusium quite entire. Spores tuberculated, with rather small subacute tubercles.

On rocks and walls. Rare and local. Between Chudleigh and Dartmoor, South Devon, Rev. W. M. Rogers; North Devon, Rev. W. S. Hore; Porlock, Somerset, Miss Edmunds; several places in North Wales and the lake district; Ingleborough, Yorkshire; Kyloe Craigs, Northumberland. Minto Craigs, Roxburgh; Arthur's Seat and Blackford Hill, Edinburgh; Stenton Rock, near Dunkeld, Perth;

Pass of Ballater; near Inver, Aberdeenshire, on granite, though in Scotland it is elsewhere found on trap rocks facing the south.

England, Scotland. Perennial. Summer, Autumn.

Fronds (including the stipes) 2 to 7 inches high; segments from $\frac{1}{2}$ to 1 inch long by $\frac{1}{10}$ to $\frac{3}{5}$ long, tapering so insensibly downwards that it is difficult to say where the lamina ends and the stalk begins. In large examples the fronds divide into two stalked portions making an acute angle with each other, and these again divide in a similar manner; but in small specimens they fork only once, and occasionally do not fork at all.

Forked Spleenwort.

GENUS XIV.—**CETERACH.** *Willd.*

Fronds produced from the apex of the caudex, tufted, subcoriaceous, pinnatifid, densely clothed beneath with imbricated ovate subcordate scales, which are at first silvery, afterwards pale reddish-brown. Stipes not articulated to the caudex, containing 2 vascular bundles which unite upwards and give a 4-lobed section in the centre of the stipes. Veins forked, the ultimate ones more or less anastomosing. Scales clathrate, composed of short cells, with thickened boundaries. Sori linear, attached along the side of the veins. Indusium absent, or rudimentary and attached along the vein.

Name from Chetherak, a name applied to some fern used by the Arabian and Persian physicians.

SPECIES I.—**CETERACH OFFICINARUM.**

PLATE 1883.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 12.
Asplenium Ceterach, *Linn.* Sp. Pl. 1538. *Hook. & Bak.* Syn. Fil. ed. ii. p. 245. *Hook. fil.* Stud. Fl. ed. ii. p. 493.
Grammites Ceterach, *Schwartz.* *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 974.
Scolopendrium Ceterach, *Symons.* *Smith*, Eng. Bot. ed. i. No. 1244; and Eng. Fl. Vol. IV. p. 315.
Gymnogramme Ceterach, *Spreng.* *Ledebour*, Fl. Ross. Vol. IV. p. 507.
Notolepium Ceterach, *Newm.* Hist. Brit. Ferns, ed. ii. p. 9, and ed. iii. p. 278; and Phytol. 1851, App. p. v.

Caudex short, dividing into several closely packed crowns. Fronds numerous from each crown, spreading. Stipes short, from $\frac{1}{6}$ to $\frac{1}{4}$ the length of the lamina, rarely more than half the length of the lamina, thickly clothed with lanceolate or ovate acuminated scales at first silvery tinged with brown, afterwards wholly brown. Lamina coriaceous, evergreen, glabrous above except for a few scattered hairs on the rachis, densely clothed beneath with imbricated broadly lanceolate scales which are at first silvery and afterwards pale rusty brown, strapshaped, tapering towards the base and apex, pinnate or very deeply pinnatipartite; pinnæ adnate by the whole of their broad base, broadly ovate-oval or ovate-oblong, entire or crenate. Venules anastomosing towards the margins of the pinnæ. Sori oblong, attached to the venules above their first fork. Indusium rudimentary, represented only by an elevated ridge extending the length of the sorus. Sori muricated, with numerous rather large acute tubercles.

Var. α. *genuina.*

Pinnæ broadly ovate-oval, entire or nearly so.

Var. β. *crenatum.* Milde.

Pinnæ oval-oblong, coarsely crenate; plant usually considerably larger than in var. α.

On walls and rocks, local but widely distributed over England. Most frequent in the south-west and west of England. Scarce in the midland counties and rare in the eastern. Very scarce in Scotland, though it extends north to the counties of Argyle and Perth. Frequent but local in Ireland, and most abundant towards the west. Var. β rare. I have wild specimens only from Ingleborough, but it is reported from many stations, particularly in the west of Ireland.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Fronds including the stipes from 1½ to 6 inches long by ⅜ to ¾ broad, deep rich green with a slightly glaucous tinge, not shining. The pinnæ more or less connected at the base, at least towards the apex of the frond. Scales dentate at the margin, thin, distinctly clathrate, their network with large meshes. Sori at first hidden beneath the scales which clothe the under surface of the frond, but ultimately appearing conspicuously through them.

Var. β is a considerably larger plant, sometimes 8 or 9 inches long by 1¾ to 2 inches broad, with the pinnæ longer and crenate or lobato-crenate at the margins, indeed it approaches somewhat in size to C. aureum, found in the Canary Isles and Madeira, but this has the rachis at first densely scaly above as well as beneath, the indusium more developed, and the spaces of the network of the scales marked with striæ; the pinnæ, moreover, are entirely repand, not lobato-crenate.

Common Scale-fern.

GENUS XV.—**SCOLOPENDRIUM.** *Smith.*

Fronds produced from the apex of the caudex, tufted, subcoriaceous, simple entire or lobed. Stipes not articulated to the caudex. Veins forked, free. Scales clathrate, composed of oblong cells with thickened boundaries as in all the true Asplenia. Sori linear, attached along the side of the veins, approximated in pairs, the anteriorly placed sorus of one vein being so close to the posterior sorus of the next vein above it, that the two appear to form but a single sorus. Indusium linear, attached along the vein, and from their approximation each pair resembles a single indusium, opening down the middle of the compound sorus.

Name from Scolopendra, a centipede, the sori being supposed to resemble the legs of the animal.

SPECIES I.—**SCOLOPENDRIUM VULGARE.** *Symons.*

PLATE 1884.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 31.
S. officinarum, *Swartz.* *Fries*, Summ. Veg. Scand. p. 83. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 984. *Rabenh.* l. c. No. 31.
S. officinale, *DC.* *Willk. & Lange*, Prod. Fl. Hisp. Vol. I. p. 5.
S. Phyllitis, *Roth*, Fl. Germ. Vol. III. p. 47.
Phyllitis Scolopendrium, *Newm.* Hist. Brit. Ferns, ed. ii. p. 10, and ed. iii. p. 272; and Phytol. 1851, App. vi.
Asplenium Scolopendrium, *Linn.* Spec. Plant. No. 1537.

Caudex thick, dividing into numerous crowns. Fronds several from each crown, ascending, arching backwards or pendulous when large. Stipes short, $\frac{1}{6}$ to $\frac{1}{2}$ the length of the lamina, purplish-brown, clothed with partially deciduous scales; scales at the very base of the stipes broadly lanceolate acute or acuminate, those higher up much smaller and narrower, glandulose ciliate at the base, with long hair-like points; upper ones and those on the rachis longer and still more resembling woolly hairs; all of them at first silvery white, ultimately rust-coloured. Lamina coriaceous, evergreen, shining and glabrous above, paler and with hair-like mostly deciduous scales beneath, strapshaped or elliptical-strapshaped or oblong-strapshaped, tapering slightly to the base, which is cordate or rarely sagittate, tapering towards the apex, which is acute or acuminate, entire or repand, rarely crenate-lobed. Veins forking, a few of them sometimes anastomosing. Rachis more or less purplish-brown in the lower portion beneath, with scattered hair-like scales beneath. Sori linear, usually equidistant from the midrib and the margin of the frond; the two portions of the compound sorus wholly coalescent. Spores muricated, with numerous prominent acute tubercles.

On rocks and hedgebanks, and in woods, frequent and generally distributed in lowland districts, more rare in Scotland, but extending to Orkney and Shetland. Frequent in Ireland.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Very variable in size and in the length of the lamina, generally speaking the larger the lamina the longer in proportion is the stipes. Of the lamina I have specimens from 4 inches long by ½ inch wide; 10 inches long by 3 inches wide; 17 inches long by 3½ inches wide; and 2 feet long by 2½ inches wide. These dimensions will show that there is a great want of regularity in the length and breadth of the fronds. Frequently the fronds are more or less undulated and sometimes crisped at the margins, but the latter seldom occurs without the sori being more or less abnormal, often short, sometimes few in number or even absent altogether.

This is one of the Ferns which are the special delight of fern-growers, from the number of remarkable monstrosities which occur. Sometimes the stipes is branched, sometimes the frond is divided into two or more divisions towards the base, but more frequently it is multifid at the apex; sometimes it is deeply lobed along the margin, with the lobes deeply crenate or incised; sometimes it is extremely short and almost reniform; sometimes there are a number of short reniform divisions; sometimes the sori are abbreviated near the margins; sometimes they are quite marginal, or even appear on the upper surface. Many of these monstrous forms can be reproduced from spores, and sometimes it is said that when part of the frond is normal and part abnormal, the spores on the normal part produce normal plants and *vice versâ*.

Hart's-tongue Fern.

TRIBE V.—BLECHNEÆ.

Caudex not growing in advance of the fronds, the stipes of which is not articulated to the caudex and does not separate from it. Sori medial, oblong or linear, straight or flexuous, continuous or more rarely separate, attached to the side of a vein which is parallel to the midrib and margin of the frond or segment, which is flat, or with its margins reflexed over the sori. Indusium attached longitudinally to the veins, or absent.

GENUS XVI.—LOMARIA. *Willd.*

Fronds produced from the apex of the caudex, which is frequently elongated and woody, tufted, rarely solitary, dimorphous, the female or fertile ones contracted. Stipes not articulated to the caudex, veins of the sterile frond forked, free, those of the fertile frond anastomosing so as to form a continuous flexuous vein on each side of the midrib, and parallel to the margin of the segment. Sori linear, continuous, attached to the inner side of the above-mentioned vein, concealed by the reflexed margin of the frond. Indusium attached along the vein which bears the sori, opening towards the midrib.

Name from λῶμα (loma), a margin or border, from the reflexed margin of the frond.

SPECIES I.—LOMARIA SPICANT. *Desvaux.*

PLATE 1885.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 91.

L. borealis, *Link*, Hort. Berol. Vol. II. p. 80.

Blechnum Spicant, *Roth.* *Moore*, Nat. Print. Brit. Ferns, 8vo. ed. Vol. II. p. 211. *Newm.* Hist. Brit. Ferns, ed. iii. p. 17. *Fries*, Summ. Veg. Scand. p. 83. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 984. *Gren. & Godr.* Fl. Fr. Vol. III. p. 639. *Rabenh.* l. c. No. 91.

B. boreale, *Swartz.* *Sm.* Eng. Bot. ed. i. No. 1159; Eng. Fl. Vol. IV. p. 316. *Bab.* Man. Brit. Bot. ed. vii. p. 453.

Osmunda Spicant, *Linn.* Spec. Plant. No. 1522.

Caudex short, thick, divided into numerous short branches or scaly crowns; scales subulate, acuminated into long slender points, dentate. Fronds of two kinds, many produced from each crown. Barren fronds spreading. Stipes short, one-twelfth to one-third the length of the lamina, with numerous scales at the base, and a few narrower deciduous ones above, purplish-brown. Lamina strapshaped, attenuated towards the base and apex or elliptical-linear, dark green above, paler beneath, coriaceous, glabrous, evergreen, pinnatipartite; segments strapshaped or linear, falcate, contiguous, adherent by their whole base, obtuse and apiculate, each with a midrib giving off veins which are once-forked and do not anastomose. Rachis green and channelled above, brown in the lower portion beneath. Fertile fronds longer than the barren ones from the same caudex, erect, with a stipes from one-third the length of to as long as the lamina. Lamina strapshaped, attenuated towards the base and apex, coriaceous, perishing in autumn, pectinate-pinnate or pectinate-pinnatipartite: segments distant, linear, contracted, with dilated bases adnate to the rachis, acute, with the margins revolute, each with a central mid-vein, which gives off venules which anastomose so as to form a flexuose vein on each side of the mid-vein and parallel to it, between which and the margins of the segments the venules are free. Rachis purplish-brown. Sori linear, attached to the longitudinal vein formed by the anastomoses of the venules, covering the whole under surface of the segments except the apex. Indusium linear, continuous. Spores faintly tuberculate, with a few small blunt tubercles.

On heaths, hedgebanks, and woods, common and generally distributed, except in chalky or limestone districts.

England, Scotland, Ireland. Perennial. Autumn.

Barren fronds, including the stipes, 6 inches to 2 feet long, but most commonly 12 to 15 inches by 1 to 2 inches broad or more; fertile fronds 1 to 3 feet high rising from the centre of the spreading sterile fronds. Like Scolopendrium vulgare, the present species produces numerous monstrous forms much prized by fern-growers. Most of these variations take place in the barren frond, although in some cases the fertile frond is also divided.

Hurd Fern.

Tribe VI.—PTERIDÆ.

Rootstock velvety, extensively creeping, growing in advance of the fronds, the stipes of which is not articulated to the rootstock and does not separate from it. Sori marginal, linear, straight, continuous, attached to a vein which is parallel to the midrib and margin of the frond or segment, which is reflexed over the sorus, and has the margins cut into capillary segments, forming an accessory indusium; true indusium attached to the vein within the sorus, membranous, fringed.

GENUS XVII.—**PTERIS.** *Linn.*

Rhizome velvety, growing in advance of the fronds. Fronds solitary, decompound, their stipes not articulated to the rootstock and not separating from it. Veins not anastomosing, but having their apices connected by a marginal vein. Sori marginal, linear, straight, continuous, attached to a vein which is parallel to the reflexed margin, lying between two membranes of which the inner one is the smaller and sometimes absent, though it is probable that it represents the true indusium, while the outer seems to be a prolongation of the epidermis of the margin of the frond.

The above description is applicable only to the genus Paesia of St. Hilaire, which appears to be the oldest name for the group containing the Brake-fern, which is almost cosmopolitan, and surely better deserves to retain the name of *Pteris* than any of the others which have been left in the genus by those who have broken it up: even those authors who include the Brake-fern in the genus Pteris admit that in habit of growth and indusium it differs not only from the genus, but also from the group Pterideæ. I have therefore retained the name Pteris, thinking that it is rather the less familiar species which do not agree with it that should be removed.

Name from πτέρις (*pteris*), a Fern.

SPECIES I.—PTERIS AQUILINA. *Linn.*

PLATE 1886.

Rabenh. Crypt. Vasc. Exsicc. No. 122.
Paesia aquilina, *Moore*, Gard. Chron. 1858, p. 878.
Ornithopteris aquilina, *John Smith*, Hist. Fil. p. 298.
Eupteris aquilina, *Newm.* Phytol. 1845, 277, and 1851, App. iii.; Hist. Brit. Ferns, ed. iii. p. 23.
Allosorus aquilinus, *Presl*, Tent. Pterid. p. 153.

Rootstock buried, creeping, clothed with very short brown tomentum; its apex growing in advance of the fronds. Fronds solitary, distant. Stipes elongate, often as long as or longer than the lamina, dark and tomentose below ground like the caudex, green or straw-coloured and channelled above ground, at first with hair-like scales, ultimately glabrous. Lamina coriaceous, perishing in autumn, light green and generally glabrous above, more or less densely pubescent beneath, bending backwards from the erect stipes, deltoid-ovate or triangular-ovate, tripinnate or bipinnate; ultimate pinnæ triangular-strapshaped, entire or crenate or pinnatifid. Indusium double, ciliated at the margin, the inner one sometimes wanting.

In heaths and woods, very common, and generally distributed.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Rootstock extensively creeping, as thick as the little finger. Fronds variable in size, sometimes not more than a foot high including the stipes, but commonly 3 or 4 feet, and not unfrequently 6 or 7; according to Mr. Moore, they reach 10 or 12 feet or even more in some cases. The smaller the frond, the more deltoid and less divided is the lamina. In the thick stipes the vascular bundle is very conspicuous, and has been fancied to represent a spread eagle; whence the name 'aquilina.' Others have seen in it a resemblance to an oak-tree, and the section is spoken of as 'King Charles in the oak.'

Mr. Francis Darwin has observed glands secreting nectar at the base of the branches of the rachis; these glands cease to secrete when the frond is mature (Journ. Linn. Soc., vol. ii. p. 407).

Mr. Moore distinguishes a variety *integerrima*, in which the secondary pinnules instead of being deeply pinnatifid are nearly entire, but this seems to be the effect of growing in poor soil.

Seedling plants have the frond much thinner in texture, and the ultimate pinnules roundish-ovate and crenate; and the same form of the plant has been found on walls.

Pt. aquilina is remarkable for the rudimentary state of the lamina when the fronds first emerge from the ground, but the after development is very rapid.

Bracken or Brake-Fern or Common Brakes.

TRIBE VII.—ADIANTEÆ.

Caudex not growing in advance of the fronds, the stipes of which is not articulated to the caudex and does not separate from it. Sori punctiform or transversely oblong, on the apex of the veins upon a portion of the frond which is bent over, forming a false indusium, with the sori on the inner surface, but there is no true indusium.

GENUS XVIII.—ADIANTUM. *Linn.*

Fronds produced near the apex of the rootstock, approximate or distant, coriaceous or herbaceous, simple pinnate or decompound; ultimate pinnules or segments commonly without a midrib or with a very eccentric one. Veins forked, free. Sporangia attached to the extremity of the veins on the reflexed flaps of the margins of the frond, which form false indusia.

Name from ἀδίαντον (*adianton*), a plant called Maidenhair.

SPECIES I.—ADIANTUM CAPILLUS-VENERIS. *Linn.*

PLATE 1887.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 11.

Rootstock creeping, rather slender, densely scaly; scales yellowish, subulate, acuminated into slender points. Fronds subsolitary. Stipes usually about as long as the lamina, slender, wiry, purplish-black, furnished at the base with a tuft of very narrowly-linear scales acuminated into slender points. Lamina submembranous, translucent, pea-green, dim, glabrous, rhombic-ovate or rhombic-lanceolate or triangular-ovate or oblong, bipinnate or tripinnate, at least below; ultimate pinnules shortly-stalked, obovate or reniform or oblanceolate or lunate, inversely deltoid or wedgeshaped or subtruncate at the base, more or less deeply inciso-crenate or palmatifid. Sori transversely oblong or transversely strapshaped, more or less curved, with the convexity of the curve pointing towards the base of the pinnæ. General and partial rachides capillary, purplish-black.

On the faces of cliffs, on limestone rocks, and in caves, usually near the sea, and high, ascending to a height of 800 feet or more in the south-west of Ireland. Rare and very local. Near St. Ives, Penzance, and other places in Cornwall; in several places about Ilfracombe; Torquay, Mr. W. A. Hayne; and near Berry Head, Devon; "Dorsetshire, Miss Payne," Wats.; Coombe Down, near Bath, Mr. E. J. Low; Dunraven, and Barry Island, and East Aberthaw, Glamorgan, said to have occurred near Stonehaven, Kincardineshire, but doubtless this is an error; also in Arran, from confounding Clyde and Galway Islands. Glenmeay, Isle of Man. In the west of Ireland in several places, between Tralee and Dingle, co. Kerry; several places in co. Clare, Isle of Arran, Galway, and perhaps further northward in the west of Ireland.

England, Ireland. Perennial. Summer, Autumn.

Rootstock from the thickness of a crow-quill to that of a goose-quill. Fronds variable in size, erect when small, drooping when large. The smallest British specimens I have are from Ilfracombe, in which the stipes is $\frac{3}{4}$ inch long, the lamina 1 inch by $\frac{1}{2}$ inch broad, and the pinnules about $\frac{1}{4}$ inch each way. Glamorganshire specimens have a stipes 1 to 3 inches long, and a lamina from 2 by $\frac{3}{4}$ inch to 6 inches by 2 inches; while specimens from the Isle of Arran, Galway, sent me by Dr. Perceval Wright, have the stipes as much as 9 inches long, and a lamina 6 inches by 4 inches, and pinnules $\frac{1}{2}$ to $\frac{3}{4}$ long by $\frac{3}{4}$ broad. The pinnules are covered with a waxy bloom from which water rolls off in drops without wetting the surface—hence the name of the genus.

There is a good deal of variation both in the shape and in the degree of incision of the pinnules; but they vary to a considerable extent, even on fronds from the same caudex.

Maidenhair.

EXCLUDED SPECIES.

ASPLENIUM REFRACTUM. *Moore.*

A. fontanum, var. *Milde*, Fil. Europ. p. 70.
A. ebeneum, *Ait.* Var. refractum, *Lowe*, Our Native Ferns, Vol. II. p. 169.

"Fronds linear, subbipinnate. Pinnæ short, oblong, obtuse, refracted, pinnate at the base, pinnatifid above. Pinnules (the lowest anterior one only distinct, the rest more or less confluent) roundish, with a few coarse angular mucronate teeth, the upper two four-toothed, the lower ones overlapping. Sori short, oblong-oblique, in a line on each side near the costa of the pinnæ. Rachis chestnut-coloured, marginate above, not winged, bulbil-bearing." Moore, 'Nat. Print Brit. Ferns,' 8vo. ed. vol. ii. p. 66.

This plant is known only in cultivation. First seen in 1851 by Mr. T. Moore, from the gardens at Peper-Harrow Park, Surrey. Afterwards exhibited by Mr. Parker, nurseryman, Hornsey.

"These plants being reported by Mr. Williams, then of Hoddesdon, to have been received by him a few years previously as A. viride, from a gardener whose friend, named Filden, who it appears died soon after the occurrence, had found them in Scotland and sent three roots."—*Moore.*

Judging from Mr. Moore's description and the figure in Lowe's 'Native Ferns,' vol. ii. pl. xlii., I believe this to be a distinct species, but the evidence that it occurred in Scotland is far too slight to entitle it to a place in the 'British Flora.'

LOMARIA ALPINA. *Spreng.*

A plant of the temperate parts of the Southern Hemisphere, which was reported to have been found by a lady "in the crevices of an old stone wall, by the side of a mountain torrent, not far from Loch Tay, Perthshire, Scotland, June, 1856." Mr. G. B. Wollaston, in 'Phytologist,' series ii. 1859, p. 157. Doubtless an error.

ONOCLEA SENSIBILIS. *Linn.*

A North American plant, which has escaped from cultivation or been planted in a few localities. Seen by Mr. H. Baines "in a lane at Moreby, near York, now extinct?" Suppl. Fl. Yorksh. p. 144, and Phytol. vol. i. p. 453. Also naturalised near Warrington, Lancashire; Mr. Borrer writes concerning it, "Onoclea sensibilis was thriving over a considerable space of boggy ground, planted as a nursery with young poplars. He (Mr. Wilson) told me that a botanical garden formerly existed there." Phytol. 1846, vol. ii. p. 432. Mr. Samuel Gilson, in 1843, speaks of it as growing "in an old stone quarry near Warrington." This fern was found "in the above locality by John Roby, Esq., of Rochdale." Phytol. vol. i. p. 492.

ORDER XCV.—**EQUISETACEÆ.**

Perennial herbs with subterraneous creeping rhizomes. Stems cylindrical, jointed, hollow, usually with verticillate branches at the top of each internode, rarely simple; internodes terminated above by a sheath ending in teeth (a whorl of connate leaves) which embraces the base of the succeeding internode. Branches jointed and sheathed similarly to the stem, sometimes absent. Sporangia opening by a longitudinal cleft, arranged 6 to 9 in a circle on the inner side of stalked peltate verticillate plates, which are arranged in an ovoid or oblong terminal spike. Spores very numerous, minute, similar; each furnished with 4 filiform appendages (elaters) which spring from one point and are thickened at the apex, at first rolled spirally round the spore, but ultimately uncoiling; the elaters are hygrometric, uncoiling when dry and rolling round the spore when damp. Prothallium green, flat, lobed, commonly diœcious, producing archegonia and antheridia resembling those of Filices.

GENUS I.—**EQUISETUM.** *Linn.*

The only genus. Characters the same as the Order.

Name from *equus*, a horse, and *seta*, a bristle.

SECTION I.—VERNALIA. *A. Braun.*

Stems of two kinds. Sterile stems appearing after the fertile stems, and perishing in winter, green or whitish, branched. Stomata level with the surface. Sheaths with persistent teeth. Branches in regular whorls, except in depauperate specimens, without any central cavity. Fertile stems appearing in early spring, decaying before summer shortly after the spike is matured, succulent, whitish, ultimately brown or fawn-colour, without branches. Spike obtuse, at first whitish, afterwards fawn-colour. Rarely a few fertile stems are produced after the sterile stems, and in that case they are thinner and less succulent than the normal fertile stems, and become whitish or green, and ultimately produce whorls of branches similar to those of the sterile stem, but shorter.

SPECIES I.—**EQUISETUM MAXIMUM.** *Lam.*

PLATE 1888.

Rabenh. Crypt. Vasc. Europ. Exsicc. Nos. 99, 100.

E. Telmeteia, *Ehrh.* in Hanov. Magazine for 1873, p. 287. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. *Gr. & Godr.* Fl. de Fr. Vol. III. p. 643. *Newm.* Brit. Ferns, ed. ii. p. 67. *Rabenh.* l.c.

E. eburneum, "*Schreb.*" *Fries*, Summ. Veg. Scand. p. 59. *Roth*, Cat. Vol. I. p. 129.

E. fluviatile, *Sm.* Eng. Bot. No. 2022; and Eng. Fl. Vol. IV. p. 337; et auct. Brit. plur. ante 1843. Non *Linn.*

Stems of two kinds, perishing in autumn. Sterile stem stout, cylindrical, with even or smooth 20 to 40 striæ scarcely observable in the living plant, smooth or slightly rough in the upper part, white. Sheaths applied to the stem, pale green with a pitchy-black ring towards the apex; teeth 20 to 40, free or some of them united in pairs or threes, subulate, very acute, pitchy-black with brown scarious margins. Branches very numerous, spreading or slightly drooping in luxuriant specimens, scabrous, 4- or 5-quetrous, with the ridges grooved and separated by rather shallow furrows, solid, unbranched or rarely with one or more branchlets, their lowest internodes falling short of the teeth of the sheath; sheath enclosing the base of the first internode of the branch, pitchy-black, with a pale brown scarious apex, furnished with short rounded lobes; sheaths at the apex of the first and succeeding internodes of the branches, terminated by triangular or triangular-subulate teeth, which have frequently setaceous points. Fertile stem short, very stout, succulent, whitish, ultimately pale brown, smooth. Sheaths close together, funnel-shaped, the lower ones overlapping each other, and even the upper frequently showing but a small portion of the stem between them, pale brown, darker towards the apex; teeth 20 to 40, many of them united into groups of 2 to 4, dark brown, subulate, not at all connivent. Spike oblong-cylindrical, obtuse, pale brown. Occasionally stems similar to the sterile stem, but terminated by a spike like the fertile ones, appear in summer or autumn.

On the banks of ponds, rivers, and ditches, and on banks of loose earth and quarry rubbish, also in damp woods and moist meadows, even growing in water. Not uncommon, and generally distributed in England. Rare in Scotland, extending to Edinburgh on the east side and Skye on the west; reported also from Fife and Forfar, but these counties require confirmation. Not unfrequent, and generally distributed in Ireland.

England, Scotland, Ireland. Perennial. Spring.

Rootstock creeping, about the thickness of a goose-quill, solid, brownish-black, pubescent. Sterile stems erect, very variable in size, but usually attaining to 2 or 3 feet, and not unfrequently even 4 or 5; and Mr. Sidebotham, in the 'Phytologist,' 1843, p. 649, says that "in a wood below Arden Hall, Cheshire, it flourishes in a swamp to the height of 6 or 7 feet." The stem is from the thickness of a swan-quill to that of a man's finger, with very numerous sheaths, all of which, except about 6 of the lowest, have whorls of branches at their base. The lowest whorls are about 1½ inch apart or more, closer together above, and quite approximate at the apex of the stem, where the branches rapidly diminish in size. The colour is pale bright-green, and the general form of the plant is cylindrical, tapering towards the lower part, and blunt at the top. Fertile stems 4 inches to 1 foot high, about the thickness of a man's little finger, tapering downwards at the base, with 7 to 18 sheaths, which are placed so closely together that the lower part of the stem, and sometimes the whole stem, is concealed. I have, however, one specimen from St. Mary's Church, Devon, in which the upper internodes are 2½ inches long, while the sheath itself is only 1½ inch. Spike 1¼ to 3 inches long, ultimately pale brown.

The form of fertile stem (var. *serotinum*, A. Braun), which resembles the barren one, is not a variety, but is due to certain conditions of growth, and is not always developed from the same plant. I have collected it myself at Haselmere, Surrey, and on the débris of the under-cliff below Fairlight Glen, Hastings, where I observed many examples of it in 1862; I have seen it also on the cliffs east of Southend, Essex, and the under-cliff at Folkestone. The Haselmere and Fairlight Glen specimens are 18 inches or 2 feet high, terminated by a spike of 1 or 2 inches; the rest of the stem is quite like the ordinary sterile plant, except that the sheaths are widened upwards, though not so much as in the sterile plant: but the Folkestone and Southend specimens are 4 to 6 inches high, with spikes ½ to 1 inch long, have the sheaths close together, much widened upwards, and so bear a much greater resemblance to the ordinary fertile stem, except in being furnished with branches.

If the rootstock be dug up at the time the sterile stem has reached its full size, the buds of the fertile spikes may be observed near its base, 1½ to 2 inches long, looking like small fir-cones from the overlapping of the teeth of the sheaths. These are developed in the succeeding spring, about March, and disappear by May, at which time the fertile stems appear, and last till October or November; perhaps if the female spikes are started into growth in the summer or autumn they develop branches.

According to Milde, the sterile stem, terminated by a spike, is the *E. eburneum* of Schreber.

Great Horsetail.

SPECIES II.—**EQUISETUM ARVENSE.** *Linn.*

PLATE 1889.

***Rabenh.* Crypt. Vasc. Exsicc. Nos. 46, 47, and 48.**

Stems of two kinds, perishing in autumn. Sterile stem rather slender, with 6 to 19 furrows, slightly rough, especially in the upper part, green. Sheaths shortly cylindrical, very slightly widened upwards, pale green; teeth 6 to 19, free or some of them united in pairs or threes, triangular-subulate acute, concolorous or edged with pale brown, with very narrow light brown scarious margins. Branches numerous, rarely few, ascending or slightly drooping in luxuriant specimens, usually 4-quetrous, with the ridges not grooved and separated by very deep furrows and the angles not grooved, solid, unbranched or rarely with a few branchlets, their lowest internode exceeding the teeth of the stem-sheath between which it is produced; sheath enclosing the base of the first internode of the branch pale brown or olive, dim, furnished with short roundish-ovate teeth with narrow pale scarious margins; sheaths at the apex of the first and succeeding internodes of the branches terminated by as many subulate teeth as there are angles on the branch. Fertile stem more or less elongated, moderately stout, succulent, whitish or pale brown, smooth. Sheaths rather distant, tubular-funnel-shaped, sulcate, whitish at the base, brown towards the apex; teeth 8 to 14, most of them often united into groups of 2 or 3, dark brown, triangular-subulate, often somewhat connivent. Spike cylindrical-oblong, obtuse, pale brown. Rarely fertile stems are produced along with or after the sterile stems, which are much firmer and greener than the ordinary state, with pale green sheaths, and these generally ultimately produce whorls of branches like those of the sterile stem, but often with the first internode of the branch not exceeding the sheath below which it is placed.

By roadsides and in waste places, and in cultivated ground, very common, and generally distributed throughout the country.

England, Scotland, Ireland. Perennial. Spring.

Rootstock rather slender, solid, with oblong pubescent tuber-like excrescences. Sterile stems erect, decumbent, or prostrate; when erect it is usually 1 to 2 feet high or even more, and frequently terminates in a long portion bare of branches, and is about the thickness of a crow-quill in the lower part, which commences to branch at the extremity of the 5th to the 14th internode, but usually about the 8th from the base. The colour is rather dull green, and the general form somewhat pyramidal or cylindrical, tapering from about the middle upwards. When growing in cultivated land a great number of decumbent or prostrate stems are produced, with long branches generally few in each whorl. In the form named *alpestre*, by Wahlenberg, which grows at Micklefell, Teesdale, the sterile stem is short, 2 to 3 inches, prostrate, with an ascending terminal point and subsecund branches. I have seen a similar form on the shores of Loch Leven.

The fertile stem is 4 inches to 1 foot high, with 4 to 8 sheaths. The spike is ¾ to 1½ inches long.

The fertile form, which afterwards throws out branches, appears to be much rarer in E. arvense than in E. maximum. I collected in September, 1838, by the side of Gartmorn Dam, near Alloa, Clackmannanshire, a fertile form, with a few branches at the base, which resembles the form called E. riparium by Fries, but its sterile stems are more branched. In 1874 a good many late fertile stems came up at Balmuto in the month of June; at first they were quite unbranched, but distinguishable by their green colour and faintly ribbed surface; their sheaths were green, less deeply sulcate than those of the ordinary fertile form. Most of these I gathered and dried as specimens. I do not know whether they would all have produced branches or not, but in July I found in the same place several specimens with developed branches, sometimes in complete whorls, but generally only 2 or 3; since that year only the ordinary forms of fertile and barren fronds have appeared. This form, when fully developed, is the var. *campestre* of C. F. Schultz, and the var. *serotinum* of F. W. Meyer; but I believe it to be only an accidental variation, not a variety.

Corn Horsetail.

SECTION II.—SUBVERNALIA. *A. Braun.*

Stems of two kinds. Sterile stems appearing at the same time as the fertile stems, or shortly after them, and perishing in winter, green or whitish, branched. Stomata level with the surface. Sheaths with persistent teeth. Branches in regular whorls, without any central cavity. Fertile stems appearing in spring, and remaining until autumn; at first somewhat succulent, whitish or fawn-coloured, and without branches; but after the spike is matured becoming firmer, white or greenish, and emitting whorls of branches similar to those of the sterile spikes, but shorter. Spike obtuse, at first greenish-white, afterwards fawn-colour.

SPECIES III.—EQUISETUM PRATENSE. *Ehrh.*

PLATE 1890.

Rabenh. Crypt. Vasc. Europ. Exsicc. Nos. 41, 42.
E. umbrosum, *Meyer*, in *Willd.* Sp. Pl. Vol. V. p. 3. *Koch*, Syn. Fl. Germ. et Helv. ed. ii. p. 965. *Hook. & Arn.* Brit. Fl. ed. viii. p. 599. *Newm.* Brit. Ferns, ed. ii. p. 63.
E. Ehrharti, *Meyer*, Chlor. Hanov. p. 666.
E. amphibolium, *Retz*, Fl. Scand. supp. 2, p. 602 (teste *Koch*).
E. Drummondii, *Hook. E. B. S.* No. 2777.
E. sylvaticum, β. minus, *Wahlenb.* Fl. Suec. p. 689, nup.

Stems of two kinds, perishing in autumn. Sterile stem slender, with 8 to 20 furrows, rather rough, green. Sheaths shortly funnel-shaped, pale green, sometimes with a pitchy-brown ring at the apex; teeth 6 to 19, usually free, rarely some of them united in pairs or threes, very narrowly triangular, hyaline with the exception of a brown central firm rib, which is generally excurrent in a small mucro, but sometimes does not reach the apex. Branches numerous, usually 3-quetrous, with the ridges not grooved, and separated by very deep furrows, solid, unbranched or rarely with a few branchlets, their lowest internode shorter than the teeth of the stem-sheath below which it is produced in the lower whorls, but equalling or exceeding them in the upper whorls; sheath enclosing the base of the first internode of the branch brown, mostly wholly scarious towards the apex, furnished with short rounded lobes; sheaths at the apex of the first and succeeding internodes of the branches, terminated by deltoid blunt teeth. Fertile stem rather short, rather stout, at first slightly succulent and reddish-white or very pale fawn-colour, ultimately firm and green, slightly scabrous. Sheaths approximate, the lower ones tubular-funnel-shaped and the upper funnel-shaped, sulcate, white with a dark reddish-brown ring at the apex; teeth 8 to 20, subulate, almost wholly scarious, some of them occasionally united into groups of 2 or 3, pale brown, with hyaline margins and a brown central firm rib as in the sheaths of the sterile stem. Branches absent until the fertile stem has attained nearly its full height, when they begin to appear; they are similar to those of the barren stem, but always shorter, generally much shorter. Spike oblong-fusiform, obtuse, at first greenish-white, afterwards fawn-colour.

In pastures, especially by the sides of streams, and on shady banks and in woods. Local and rather rare, extending from Westmoreland (or perhaps Lancashire) and Yorkshire to Lanark, Stirling, Perth, Banff and Caithness. Local in Ireland, and confined to the North; most plentiful in the mountain glens of Antrim.

England, Scotland, Ireland. Perennial. Late Spring and early Summer.

Rootstock slender, without tubers. Sterile stem from the thickness of a stocking-wire to that of a crow-quill; usually 9 to 18 inches high. Plant pale green, somewhat cylindrical, usually blunt-topped, sometimes bending over at the apex, with the branches spreading or drooping and slightly arching, occasionally somewhat secund. Fertile stem appearing in April or the beginning of May, 4 to 14 inches high. The sheaths are wider, the higher they are placed on the stem. Spike $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

A very distinct species, though the barren stems are sometimes mistaken for those of E. arvense, but the teeth of the sheaths are very different, being entirely transparent except the thickened central rib. The branches are generally triquetrous, not usually tetraquetrous as in E. arvense; the first internode of the branch rarely reaches even to the base of the teeth of the stem-sheath below which it springs; while in E. arvense it generally exceeds, and always attains, the level of the apex of the teeth. The little sheaths from which the branches spring are distinctly toothed in E. arvense, which is not the case in E. pratense; and this latter has the teeth of the sheaths of the branches very obtuse, while they are acute in E. arvense. The fertile stems are not likely to be mistaken, the sheaths are so different; those of E. arvense have the central rib furrowed on the back, and the teeth with very narrow scarious margins, while in E. pratense the central rib has no furrow on the back, and except a small projection at the base, from which the rib springs, they are wholly scarious.

The fertile stems of E. pratense are to be compared with those occasionally found in E. maximum and E. arvense which ultimately produce branches. E. pratense has never, so far as I know, any form of fertile stem analogous to the ordinary fertile stems of E. maximum and E. arvense.

Blunt-topped Horsetail.

SPECIES IV.—EQUISETUM SYLVATICUM. *Linn.*

Plate 1891.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 43.

Stems of two kinds, perishing in autumn. Sterile stem rather slender, with 10 to 18 furrows, separated by ridges, usually furnished with lines of minute spreading bristle-like processes which are longest immediately beneath the sheaths, or rarely nearly smooth, pale green. Sheaths cylindrical, green, reddish-brown at the apex; teeth 10 to 18, generally combined into 3 or 4 obtuse hooded lobes, rarely any of them free, linear-subulate, reddish-brown or more rarely pitchy-brown, scarious, with the exception of a concolorous firm central rib, which reaches to the tip, but is not excurrent. Branches very numerous, usually tetraquetrous, with the ridges faintly grooved and separated by very deep furrows, solid, much branched, their lowest internode is sometimes shorter than the teeth of the stem-sheath below which it is produced, but exceeding them in the upper whorls; sheath enclosing the base of the first internode of the branch olive, scarious and reddish-brown at the apex, furnished with long triangular acute teeth; sheath at the apex of the first and succeeding internodes terminated by subulate very acute teeth. Branchlets trigonous, their sheaths with very long subulate teeth curving away from the branchlet. Fertile stem elongate, rather stout, at first somewhat succulent and pale fawn-colour, ultimately firm and pale green, less deeply striated and smoother than in the barren stem. Sheaths rather distant, loose longly cylindrical, contracted at the apex, their teeth collected into a few blunt much-hooded lobes, marked with lines indicating the midribs of the teeth, striate, but scarcely sulcate even at the base. Branches absent until the fertile stem has attained nearly its full height, when they begin to appear; they are similar to those of the barren stem, but usually, though not always, shorter. Spike oblong-cylindrical or oblong-fusiform, at first greenish-white, afterwards fawn-colour.

In moist woods and by the sides of streams, roadsides, and waste places, and on heaths. Rather common and generally distributed throughout England and Scotland, extending to Orkney and Shetland. Not infrequent throughout Ireland.

England, Scotland, Ireland. Perennial. Spring and early Summer.

Rootstock rather slender, angular, with a ring of open tubes running through it, producing brown acuminated tubers. Stems usually 1 foot to 18 inches high, and rarely exceeding 2 feet; remarkable for the lines of bristle-like projections on the ridges of the stem; these bristles vary much in length, and sometimes are altogether absent; I have specimens from Kingcansie, Kincardineshire, and Cullalo, Fifeshire, in which they are wanting, but differ in no other respect from the ordinary form. The plant is bright green, the form somewhat pyramidal from where the branches begin, which is at about the 6th to the 8th internode; the branches are always arched and drooping, and the top of the stem is also drooping and secund. The fertile stems are at first from 9 to 15 inches high, and at that time are succulent and terminated by a spike $\frac{3}{4}$ to $1\frac{1}{4}$ inch long; afterwards the branches begin to appear, and are short and recurved; the stem continues to lengthen, to become firmer, and the branches to increase in size, the spike withers away; and ultimately the fertile frond is distinguishable from the barren one mainly by its being truncate at the top, where usually the withered remains of the spike may be found. The fertile stem is generally smooth, and the first internode of the branches shorter than the stem-sheath below which it is produced.

A well-marked species, from its compound drooping branches, and sheaths with the teeth combined so as to appear lacerate rather than toothed.

Wood Horsetail.

SECTION III.—ÆSTIVALIA. *A. Braun.*

Stems all similar, or nearly so, perishing in winter, green or whitish, smooth to the touch or nearly so, branched. Stomata level with the surface. Sheaths with persistent teeth. Branches in regular whorls, except in depauperate specimens, with a central cavity; rarely the branches are absent. Fertile stems differing from the sterile ones only in being terminated by a spike, which is perfected in summer. Spike blunt or rarely slightly apiculate, usually black or dark brown.

SPECIES V.—**EQUISETUM PALUSTRE.** *Linn.*

PLATE 1892.

Rabenh. Crypt. Vasc. Europ. Exsicc. Nos. 69, 70, 71.

Stems all similar, perishing in autumn. Sterile stem rather slender or with 5 to 12 furrows, which are rather shallow in the living plant, but become deeper in dried specimens, separated by ridges which are not grooved, slightly rough, green. Sheaths shortly cylindrical-funnel-shaped, green, often pitchy-brown towards the apex; teeth 5 to 12, mostly free, or more rarely some of them united in pairs or threes, narrowly triangular, acute, dark brown or pitchy-black, with very broad pure white hyaline margins. Branches usually in whorls, but sometimes only 1 or 2 from a node, and sometimes wholly absent, generally 5-angular, but varying from 4- to 7-angular, with the ridges separated by very shallow furrows, hollow, unbranched, their lowest internode much shorter than the teeth of the stem-sheath below which it is produced, and indeed reduced to little more than a sheath; sheath enclosing the base of the first internode of the branch pitchy-brown or nearly black, shining, with deltoid-ovate obtuse teeth having very narrow pale brown or whitish scarious margins; sheath at the apex of the first internode terminated by deltoid-ovate blunt teeth; teeth of the succeeding internodes ovate or ovate-lanceolate, with a weak mucro. Fertile stem differing from the sterile one only in being terminated by a spike which is ovoid-oblong or cylindrical-oblong, obtuse, pitchy-black.

In bogs and marshes, and on the shores of lakes and ponds and on wet rocks. Common and generally distributed throughout England and Scotland, extending to Orkney and Shetland; frequent throughout Ireland.

England, Scotland, Ireland. Perennial. Summer.

A very variable plant. The commonest form has erect stems, 1 foot high or more, but the length of the stem varies from a few inches to 2 feet. The plant is of a rather dull green, and is narrowly pyramidal when branched. When unbranched it is the var. *nudum* of Duby, but unbranched stems may be seen springing from the same rootstock as branched ones. The stems grow more in tufts than in any of the preceding species, and in this respect resemble the Equiseta hyemalia. Frequently the stem is decumbent or prostrate and without branches, when it is the var. *nudum* of Newman (' Brit. Ferns,' ed. ii. p. 49), but not of Duby, the var. *alpinum* of Hooker, and var. *subnudum* of the London Catalogue of British Plants; but this appears to be merely a starved state of the plant. The spike is $\frac{1}{4}$ to $\frac{7}{8}$ inch long, and is produced in June or July.

An extraordinary state of the fertile stem, in which 1 or more of the upper branches are terminated by spikes, has received the name of var. *polystachyum*; but this is evidently a monstrosity rather than a variety. Very often the main central stem has been accidentally injured, so that there is no spike at its apex; but specimens occur which have not only a spike on the main stem, but also minute ones on the branches, which are much elongated.

The barren fronds of E. palustre are much like those of E. arvense, but may be readily distinguished by the teeth of the stem-sheaths being darker, and with a broader white margin; by the minute sheaths from which the branches spring being pitchy-brown or black and shining; by the branches being hollow and most commonly 5-angled, and with the faces between the angles not excavated into deep grooves; by the teeth of the sheaths of the branches being much shorter and sulcate; and above all, by the first internode of the branches being extremely short, rarely reaching even to the base of the teeth of the stem-sheath, while in E. arvense it almost always exceeds the apex of the teeth of the stem-sheath.

Marsh Horsetail.

SPECIES VI.—EQUISETUM LIMOSUM. *Smith.*

PLATE 1893.

E. fluviatile (*Linn.*), *Newm.* Brit. Ferns, ed. ii. p. 51. *Hartm.* Handb. Skand. Fl. ed. xi. p. 548. Non *Sm.*

Stems all similar, perishing in autumn. Sterile stem stout, rarely rather slender, not furrowed when fresh, but with 10 to 25 faint striæ (which are more conspicuous in the dried plant), smooth, green. Sheaths shortly cylindrical or funnel-shaped-cylindrical, green, often pitchy-black towards the apex; teeth 10 to 25, mostly free, but sometimes united in pairs or threes, narrowly triangular or triangular-subulate, acute, usually pitchy-black or at least tipped with that colour, with very narrow pale brown scarious margins. Branches usually in whorls, but sometimes only 1 or 2 from a node, and often wholly absent, generally 4-angular but sometimes 5- to 6-angled, with the ridges separated by very shallow furrows, hollow, unbranched, their lowest internode shorter than the teeth of the sheath-stem below which it is produced; sheath enclosing the base of the first internode of the branch pitchy-brown or olive, dim with deltoid-ovate subacute teeth, without whitish margins; sheath at the apex of the first internode terminated by triangular-acute teeth, and those of the succeeding internodes with subulate very acute teeth. Fertile stem differing from the sterile one only in being terminated by a spike which is oval-ovoid or ovoid-oblong, obtuse, pitchy-black or pitchy-brown.

Var. α. *genuinum.*

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 74.
E. limosum, *Linn.* Spec. Plant. p. 1517. *Fries*, Summ. Veg. Scand. p. 59.
E. limosum, var. Linnæanum, *Döll; Milde*, Fil. Europ. p. 227.

Stem unbranched, or with a few irregular solitary or subsolitary branches.

Var. β. *fluviatile.*

Rabenh. Crypt. Vasc. Europ. Exsicc. Nos. 75 and 124.
E. fluviatile, *Linn.* Spec. Pant. No. 1517. *Fries*, Summ. Veg. Scand. p. 59. Non *Smith.*
E. limosum, var. verticillatum, *Döll; Milde*, Fil. Europ. p. 227.

Stem with regular whorls of branches. Stem stouter than in var. α, and when barren with a longer point.

In lakes, ponds, and ditches, growing in the water, or rarely in wet places out of water. Frequent and generally distributed throughout England and Scotland, extending to Orkney and Shetland. Common in Ireland.

England, Scotland, Ireland. Perennial. Summer.

Rootstock hollow. Stems erect, dark green, scarcely striated, when growing easily compressible from having a large central hollow and thin walls, which are not strengthened by a cylinder of thickened cells as in all the other British species of Equiseta. In var. α they vary from the thickness of a crow-quill to that of a swan-quill; but in var. β they are frequently as thick as a man's little finger. The unbranched forms are nearly as common as the branched. When growing in bogs or shallow water the branches are commonly absent, but they are so also not unfrequently even in deep water, in which the plant attains its greatest development, reaching a height of 3 or 4 feet, or even more. It is in deep water too that the barren stems terminate in a long naked point. The spike is ½ to ¾ inch long, less cylindrical than in the preceding species, and often paler in colour. A 'polystachyum' form occurs, but much more rarely than in E. palustre.

The absence of furrows on the stem distinguishes all the forms of this plant from those of E. palustre when the plants are fresh. In the dried state the outside of the stem shrinks so that it appears furrowed; but the narrower teeth, without conspicuous white margins, should be enough to distinguish this from E. palustre. The want of a cylinder of thickened cells is a characteristic of this species; indeed, it occurs in only one other European form, namely, E. littorale of Kühlew, which is generally believed to be a hybrid between

E. limosum and E. arvense. If this be so, it is not unlikely to occur in Britain. E. littorale has the general habit of the forms of E. arvense which have branched fertile stems, but the rootstock is angular and hollow, and there is no ring of thickened tissue in the stem; the branches also are generally hollow.

E. limosum is a variable plant, but the variations run too much into each other to be separable into varieties; even the two forms which I have admitted as varieties are most difficult to define, and may very possibly be merely states of the plant due to external circumstances. I have, however, retained them, as they are generally accepted in this country, and were considered distinct species by both Linnæus and Fries.

Water Horsetail.

SECTION IV.—HYEMALIA. *A. Braun.*

Stems all similar, persisting, green, rough to the touch, branched or unbranched. Stomata sunk in depressions so as to be below the general surface of the epidermis. Sheaths with persistent or deciduous teeth. Branches usually solitary, rarely in whorls, often absent, with a central cavity. Fertile stems differing from the sterile ones only in being terminated by a spike, which is perfected in autumn or late summer. Spike mucronate or apiculate, usually black.

SPECIES VII.—EQUISETUM HYEMALE. '*Linn.*' (auct. plur.)

PLATES 1894 AND 1895.

Stems all similar, sub-evergreen, solitary or several together from each node or extremity of branch of the rootstock rather stout or rather slender, with a central hollow of $\frac{2}{3}$ or $\frac{1}{2}$ its diameter, with 8 to 34 rather shallow furrows, separated by subobtuse edges, which are not furrowed on the back, and are rough, with small prominent tubercles arranged in one stripe on each ridge, dull dark green. Sheaths cylindrical, applied to the stem or slightly widened upwards, at first pale green and concolorous, then with a black band at the apex and afterwards another at the base, afterwards wholly black, ultimately white with a black band at the base and a narrower one at the apex; the lower ones permanently black; each of the portions of the sheath which corresponds to one of the teeth with a narrow shallow furrow down the centre, and another similar furrow on each side, midway between the central furrow and the great furrow which extends (between the teeth) from the apex to the base of the sheath; teeth

8 to 34, deltoid-triangular or triangular, acuminated into long setaceous-subulate flexuous or straight points, which are wholly scarious, pitchy-black, with narrow paler margins, and are often caducous except on the terminal sheaths, in which case by their fall they leave the sheaths truncate and crenate—these crenatures corresponding with the bases of the teeth; more rarely the points of the teeth of all or of some of the sheaths are persistent. Branches very rarely produced, and then solitary, resembling the stem in miniature, with the first internode much shorter than the stem-sheath below which it is produced; sheath enclosing the first internode of the branch pitchy-black, shining, oblique; sheaths at the apex of the first and succeeding internodes of the branch terminated by triangular teeth with deciduous subulate scarious points. Spikes oval- or roundish- or oblong-ovoid, acuminated and mucronate or apiculate, pitchy-black or pitchy-brown, its base embraced by the teeth of the uppermost stem-sheath.

SUBSPECIES I.—Equisetum eu-hyemale.

PLATE 1894.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 49.
E. hyemale, *Newman*, Phytol. 1854, p. 19.
E. hyemale, var. genuinum, *A. Braun; Milde*, Fil. Europ. p. 243.

Stems all similar, sub-evergreen, mostly solitary from each node or extremity of branch of the rootstock, rather stout, with a central hollow of about two-thirds its diameter with 15 to 34 rather shallow furrows separated by subobtuse ridges, which are not furrowed on the back, and are rough with small prominent tubercles arranged in one stripe on each ridge, dull dark green. Sheaths cylindrical, closely applied to the stem, pale green, at first concolorous, then with a black band at the apex and afterwards another at the base, afterwards wholly black, ultimately white with a black band at the base and a narrower one at the apex, the lower ones permanently black; each of the portions of the sheath which corresponds to one of the teeth with a narrow shallow furrow down the centre, and another similar shallow furrow on each side between the central furrow and the great furrow which extends (between the teeth) from the apex to the base of the sheath; teeth 15 to 34, deltoid-triangular, acuminated into long setaceous, subulate flexuous or crisped roughish points, which are wholly scarious, pitchy-black with narrow paler margins, and are caducous except on the terminal sheath, so that by their fall the sheath is left truncate and crenate; these crenatures correspond with the bases of the teeth. Branches absent or very rarely produced, and then solitary, resembling the stem in miniature, with its first internode much shorter than the stem-sheath, below which it is produced; sheath enclosing the first internode of the branch pitchy-black, shining, oblique; sheaths at the apex of the first and succeeding internodes of the branch terminated by triangular teeth with deciduous subulate scarious points. Spike oval- or roundish-ovoid, acuminated and mucronate, pitchy-black or pitchy-brown, its base embraced by the persistent teeth of the uppermost stem-sheath.

In moist woods and on wet banks and bogs, and in wet places amongst sandhills, rare, from Kent, Surrey, Hereford, and Glamorgan to Aberdeen, Banff, Elgin, Ross, Perth, Lanark, and Ayr. Rare, but distributed from north to south of Ireland.

England, Scotland, Ireland. Perennial. Late Summer, Autumn.

Rootstock creeping, black, hollow. Stems 1½ to 2½ feet high; usually about the thickness of a goose-quill or a swan-quill, so rough on the ridges as to make a distinctly grating sound when the finger-nail is drawn along them; spaces between the ridges transversely rugose, with a line of stomata sunk in depressions at the base of the ridges on each side. Sheaths usually about ¼ inch long, appearing truncate by the scarious part of the teeth separating as the stem developes. The teeth of the uppermost sheath, which is funnel-shaped and embraces the base of the spike, are always persistent, and are slightly rough and crisped or twisted. Very rarely the teeth of the stem-sheaths are persistent, in which case they are at first black, but afterwards become hyaline. Branches rarely produced. I possess but a single specimen which has a branch from near the apex of the stem; it was gathered by Mr. Roy, at Banchory, Kincardineshire. Spike ¼ to ½ inch long.

The stems survive the winter, but are more or less killed at the apices, and in severe winter sometimes down to the ground.

From the roughness of the stems caused by particles of silica, they are capable of being used "as a file in polishing wood, ivory, or even brass. This purpose it has long served in England, under the name of Dutch Rushes, being usually imported from Holland." (Sm. Eng. Flor. vol. iv. p. 340.)

Rough Horsetail; Dutch Rush; or Shave-grass.

SUBSPECIES II.—**Equisetum Moorei.** *Newm.*

PLATE 1895.

Rabenh. Crypt. Vasc. Europ. Exsicc. No. 501.
Newman, Phytol. 1854, p. 19.
E. hyemale, var. Moorei. *Hook. & Arn.* Brit. Fl. ed. viii. p. 601. *Bab.* Man. Brit. Bot. ed. vii. p. 440. *Hook. fil.* Stud. Fl. ed. ii. p. 502.
E. hyemale, var. Schleicheri. *Milde,* Fil. Europ. p. 244.
E. paleaceum, "*Schleicher,* e p.;" e p. *Milde,* l.c.
E. trachyodon, *Rabenh.* l.c. No. 50. Non *A. Braun.*

Stems all similar, sub-evergreen, usually in tufts of 3 or 4 together from each node, or extremity of branch of the rootstock, rather slender, with a central hollow of about half its diameter, with 8 to 15 ("to 23," Milde) rather shallow furrows, separated by subobtuse ridges, which are not furrowed on the back, and are rough with small prominent tubercles arranged in one stripe on each ridge, dull dark green. Sheaths cylindrical-funnel-shaped, a little widened upwards, pale green, at first concolorous, then with a black band at the apex and afterwards another at the base, ultimately white with a black band at the base and a narrower one at the apex; the lowest ones permanently black; each of the portions of the sheath which corresponds to one of the teeth with a narrow shallow furrow down the centre, and another similar furrow on each side between the central furrow and the great furrow which extends (between the teeth) from the apex to the base of the sheath; teeth 8 to 16, triangular, acuminated into long setaceous-subulate straight or slightly flexuous points, which are wholly scarious, pitchy-black with narrow paler margins and persist until the stems are full grown; but in the succeeding winter or spring many of them fall off and leave the sheaths truncate and crenate, the crenatures corresponding to the bases of the teeth. Branches absent, or very rarely produced, solitary or two at a node, resembling the stem in miniature, with the first internode much shorter than the stem-sheath below which it is produced; sheath enclosing the first internode of the branch pitchy-black, shining, oblique; sheaths at the apex of the first and succeeding internodes terminated by subulate persistent teeth. Spike oblong-ovoid, acuminated and shortly mucronate, pitchy-black, its base embraced by the teeth of the uppermost stem-sheath.

On wet rocky banks and on open sandhills, very rare. "Sandhills north of Courtown, County Wexford, and sandhills near Arkwell, and thence northwards in many places along the coast extending to near Seamark House, County Wicklow." (A. G. More.) First found by the late Dr. D. Moore, 1861, on wet rocky banks facing the sea, and on open ground facing Rochfield, not far from Dunganstown, Wicklow. Mr. A. G. More says, the plant of Dundrum Sandhills "should probably be referred to E. Moorei." This would extend the range of the plant to County Down.

Ireland. Perennial. Autumn.

Stems 1 to 2 feet high, from the thickness of a stocking-wire to that of a crow-quill; sheaths about $\frac{1}{4}$ inch long exclusive of the teeth. Spike $\frac{1}{4}$–$\frac{3}{8}$ of an inch long.

E. Moorei differs from E. eu-hyemale in its much smaller size, more deeply furrowed stem of which the sheaths are slightly widened upwards and have the teeth persistent; the points of the teeth are firmer in texture, and many of them remain attached to the sheaths until winter, and even in spring may be found on stems which have not been killed by frost.

One of the characters which was considered distinctive of E. Moorei, in the original notice of it, is apparently not constant. Dr. D. Moore writes in December, 1853, "The stems of all our British unbranched species of Equisetum are persistent, *remaining green throughout the winter*. The economy of the plant to which I am now directing your attention is the reverse of this: *the stems die down annually*" (Phytol. 1854, p. 18). I have cultivated this for more than four years from roots sent me by Dr. Moore, and I find that they are scarcely more tender than those of E. eu-hyemale grown along with it; neither form is completely evergreen, being more or less killed downwards from the top according to the severity of the frost.

Mr. A. G. More, writing from Glasnevin in May 1869, says that "none of E. Moorei are quite dead, nearly all are green $\frac{3}{4}$ up," and in the 'Journal of Botany' for 1868, p. 253, he writes, "In the wild state the stems are not strictly deciduous, for in sheltered situations among bushes I have found them quite green and fresh even so late as in the month of March; and if on the open sandhills they are more or less withered, I believe that this may be due simply to exposure." Mr. J. G. Baker in a letter says, concerning the stems of E. Moorei, "They are just the same in texture as in E. hyemale, but perhaps—I am not even certain as to that—cut up by frost rather earlier."

In cultivation at Balmuto it has remained unchanged; and is in habit and general appearance much more like E. trachyodon than E. eu-hyemale.

According to Milde, E. paleaceum (Schleicher) which is the oldest name, is to be rejected, as by it plants quite different from each other are intended by different authors and even by Schleicher himself. That being the case, Mr. Newman's name Moorei is antecedent to the

Schleicheri of Milde, and the name Moorei is now generally used in British Floras.

Moore's Horsetail.

SPECIES VIII.—EQUISETUM TRACHYODON. *A. Braun.*

PLATE 1896.

E. Mackaii, *Newm.* Hist. Brit. Ferns, ed. ii. 1844, p. 25.
E. hyemale, var. Mackaii, *Newm.* Phytol. 1842, p. 305.
E. variegatum, var. trachyodon, *Hook. fil.* Stud. Fl. ed. ii. p. 502.
E. elongatum, *Hook.* Lond. Journ. Bot. 1842, p. 42. Non *Willd.*
E. ramosum, *Benth.* Handb. Brit. Fl. p. 620. Non *DC.*

Stems all similar, completely evergreen, usually several together from each branch of the rootstock, rather slender, with a central hollow about one-third of its diameter, with 8 to 14 rather shallow furrows separated by acute-angled ridges, which are furrowed on the back, and are rough with small prominent tubercles arranged in 2 lines on each ridge, dull dark green. Sheaths shortly cylindrical, closely applied to the stem, at first green and concolorous, then with a black band at the apex, soon becoming wholly black, but ultimately usually having a narrow whitish ring below the narrow black apical band; each of the portions of the sheath which corresponds to one of the teeth with a rather broad deep furrow in the centre, and another broad shallow rather indistinct furrow on each side between the central furrow and the great furrow which extends between the teeth from the apex to the base of the sheath; teeth 8 to 14, triangular-subulate, gradually acuminated into long subulate-setaceous straight rough firm persistent points, pitchy-black, with rather narrow paler or white scarious margins, furrowed on the back, persistent, though sometimes their points get broken off, occasionally becoming nearly wholly white when old. Branches absent, or rarely produced unless the main stem be injured, and then solitary, resembling the stem in miniature, with its first internode much shorter than the stem-sheath below which it is produced; sheath enclosing the first internode of the branch, pitchy-black, shining, irregularly toothed; sheath at the apex of the first internode of the branch terminated by ovate-triangular apiculate pitchy-black teeth without furrows on the back; the succeeding ones similar to those on the main stem, pitchy black. Spike oval-ovoid, abruptly acuminated and mucronate, pitchy-black, its base embraced by the teeth of the uppermost sheath.

In wet, shady places, very rare. On the banks and in the water of the Dee, at intervals of 6 or 7 miles within the parish of Banchory-Ternan, Kincardineshire, the Rev. J. M. Brichan, who says, "It appears to prefer a locality where water oozing from the bank forms a moist green spot, or finds its way through a rent made by the river, or a channel worn by itself. The water where E. Mackaii thus fixes its habitat, is generally, if not invariably, chalybeate." (Phytol. 1842, p. 371.) The Aberdeen botanists, however, do not seem to have observed this plant, as in answer to inquiries Dr. G. Dickie replied in Nov. 1874, "I know nothing of Equisetum trachyodon in this quarter; Mr. Roy says the same." Perhaps some form of E. hyemale or E. variegatum, both of which certainly grow by the Dee, may have been mistaken for E. trachyodon, but Mr. Brichan's description appears to agree best with the true plant.

Moist banks near a waterfall at the upper end of Colin Glen, Belfast, where it was found in August 1833, by Mr. J. T. Mackay, in company with Mr. F. Whitla. In Ballynarrigan Glen, near Dungiven, Derry, and in several glens near Glenarm, Antrim, Dr. D. Moore, in Drunnan Wood, and on the adjacent shores of Loch Cullin, Mayo, Mr. A. G. More. In two places by the side of the stream in Chevy Chase, about 7 miles south-east from Gort, co. Galway, Mr. H. C. Hart. Near St. Ann's, Blarney (R. Mills), Rev. T. Allin.

Scotland, Ireland. Perennial. Late Summer and Autumn.

Plant erect, or more or less decumbent, 1 to 2 feet high, from the thickness of a stocking-wire to that of a crow-quill. Sheaths $\frac{1}{8}$ to $\frac{1}{6}$ inch exclusive of the teeth, which are stiff and persistent; uppermost sheath which embraces the spike funnel-shaped, gradually narrowed upwards, with lanceolate teeth having broad white margins and brown scabrous flexuous points. Spike about $\frac{1}{4}$ inch long, abruptly acuminated into a short mucro.

Branches are much more frequently produced in E. trachyodon than in any of the forms of E. hyemale. They may come from any part of the stem, and sometimes have a secondary branch from one of their internodes. In the 'Cybele Hibernica' it is stated that "after a series of careful observations made in Antrim, Mr. D. Orr considers that the normal state of E. trachyodon is the unbranched form. In exposed situations, when broken by the wind or injured by cattle, the stems throw out lateral shoots from near the point of injury." (Cyb. Hib. p. 365.)

E. trachyodon is very similar in general appearance to E. Moorei, so much so that many excellent botanists appear to have mistaken the one for the other, as instanced in Rabenhorst's published fasciculi. In E. trachyodon, however, the ridges of the stem are not rounded on the back, but slightly grooved, and present two sharp angles towards the furrows, and the rough points with which they are furnished are arranged in two distinct lines. The sculpture of the sheaths and teeth is different, the central furrow running into each tooth is deeper, and the lateral furrows are wider and shallower than in E. Moorei. The points of the teeth are firmer, not being wholly scarious, but having a furrowed rib of firm tissue running along them; this rib is of a pitchy-black colour, and is bordered with pale or whitish scarious margins. The teeth are much more persistent; the sheaths become sooner black and remain much longer so, not assuming a whitish tinge until the winter. The stems are completely evergreen. I have not found it injured by frost since 1876, when I received living specimens from Mr. S. A. Stewart, of Belfast, which have grown in the open ground up to 1881.

Mackay's Horsetail.

SPECIES IX.—EQUISETUM VARIEGATUM. *Schleich.*

PLATES 1897 AND 1898.

Rabenh. **Crypt. Vasc. Europ. Exsicc. Nos. 73 and 98.**

Stems all similar, completely evergreen, usually several together from each branch of the rootstock, slender or rather slender, rarely stout, with a central hollow of one-fifth to one-third of its diameter, with 4 to 12 shallow furrows separated by subacute-angled ridges, which are rough with small prominent tubercles arranged in two lines on each ridge and furrowed on the back, dull dark green. Sheaths shortly (rarely longly) cylindrical-turbinate, yellowish-green, at first concolorous, then with a black band at the apex ultimately extending downwards until nearly the whole sheath becomes black, but usually without a black band at the base, and rarely wholly black, each of the portions of the sheath which corresponds with one of the teeth with a rather broad deep furrow in the centre, and another broad shallow rather indistinct furrow on each side between the central furrow and the great furrow which extends between the teeth from the apex to the base of the sheath; teeth 4 to 12, triangular-lanceolate or triangular-ovate, abruptly or rather abruptly acuminated into setaceous straight rough firm mostly caducous points, pitchy-black with broad white scarious margins, furrowed on the back, persistent, though generally their points either fall or get broken off, occasionally becoming nearly wholly white when old. Branches rarely produced unless the main stem has been injured and then solitary or in pairs, resembling the stem in miniature, with the first internode much shorter than the stem-sheath, below which it is produced; sheath enclosing the first internode of the branch, pitchy-black, shining, irregularly toothed; sheath at the apex of the first and succeeding internodes of the branch terminated by ovate-triangular apiculate pitchy-black teeth without furrows on the back; the succeeding ones similar to those on the main stem. Spike oblong- or oval-ovoid, abruptly acuminated and mucronate, pitchy-black, its base usually embraced by the teeth of the uppermost stem-sheath.

Var. α. *genuinum.*

PLATE 1897.

E. variegatum, var. arenarium, *Newm.* *Bab.* Man. Brit. Bot. ed. viii. p. 451.

Stem usually slender, often very slender, flexuous, decumbent or prostrate; stem ridges each with 2 acute angles, and a conspicuous central furrow.

Var. β. *majus.*

Stem rather slender, not flexuous, erect; stem ridges each with 2 acute angles and a conspicuous central furrow.

Var. γ. *Wilsoni.* Newm.

PLATE 1898.

Stem stout, not flexuous, erect, stem ridges with 2 obtuse angles and a shallow central furrow, less rough than in vars. α and β.

Var. α in damp places on sandhills, and on damp rocks and by the sides of streams. Rare. Salcombe cliff, near Sidmouth, Devon; reported from Somerset and Flint; plentiful on the sandhills at the mouth of the Mersey, as at Wallasey and New Brighton, Cheshire, and at Bootle, Crosby and Southport, Lancashire; near Settle, Yorkshire; Teesdale; in several places by the river Irthing, near Wardrew, Northumberland, and by the same river above the upper stepping-stones at Gilsland, Cumberland. In Scotland it is reported from the Clyde Islands (Prof. Balfour, Top. Bot.); Frankfield Loch, Lanark; North Berwick, Haddington; near Largo and Tentsmuir, Fife (Mr. C. Howie); sands of Barry, Forfarshire; banks of the Dee, Kincardineshire; near Tain, Ross-shire. In Ireland it is found on sandhills at Port Marnoch and Port Crane, Dublin;

sandhills at Mullaghmore, and rocks at Glencar, co. Sligo; sandhills at Benone, Magilligan, Derry.

Var. β, banks of the Dee at Durra, Kincardineshire; by the Royal Canal at Dublin; east of Clonsella Station, and a little below the bridge at Cross Duns, near Glasnevin; canal at Mullingar; margins of the pool of water on the Hunting Course field west of Castle Taylor; and shore of Loch Bulard, near Roundstone, Galway; and perhaps shore of Loch Carra, Mayo.

Var. γ in ditches by the side of the Lake of Killarney, at Mucruss, County Kerry.

England, Scotland, Ireland. Late Summer, Autumn.

A very variable plant, with stems from 3 or 4 inches to 2 feet long, and from the thickness of a darning-needle to that of a crow-quill or more; they are generally more or less decumbent, especially when growing on sandhills; usually they are unbranched, but I have specimens from Wallasey sandhills upon which there are branches from many of the internodes; these branches are either solitary or in pairs, and in the latter case opposite, or very rarely on the same side of the stem. The branches occasionally terminate in spikes, and indeed seem to be more like secondary stems than anything else. The sheaths vary considerably in length and in colour, but are always enlarged upwards, and then again slightly contracted; the teeth are also very variable, even in specimens from the same locality; they are usually rather short and blunt, with broad white margins, and are generally abruptly acuminated into a long white setaceous point, which either falls off or is very liable to be broken off. Among the specimens I have from Wallasey sandhills, collected by Mr. H. S. Fisher in 1871, there are some in which the teeth of the sheaths are triangular and gradually acuminated into subulate points, and have only narrow white margins, though others collected at the same place and at the same date have teeth of the ordinary form.

Var. β scarcely appears to pass insensibly into the ordinary form. The plant from the Dublin Canal I have cultivated for about five years from roots sent me by the late Dr. D. Moore; these have remained stouter and more erect than those of var. *genuinum* grown beside them, and divide below ground, while in var. α the stems come in tufts from the branches of the rootstock above ground; the stems, however, do not exceed 1 foot high, while in the Dublin Canal they are twice as long, probably growing more luxuriantly from being in the water. The plants from the banks of the Dee, Kincardineshire, are intermediate between the Dublin Canal plant and the var. *genuinum*, but they have longer teeth and blacker sheaths. Specimens from the bridge of Potarch, Kincardineshire, collected by Mr. J. Sim in 1871, have stout stems, with short almost wholly black sheaths, and lanceolate-subulate gradually-acuminate teeth, having rather narrow scarious margins; this form may be the var. *pseudo-elongatum* of Milde.

I have been unable to procure specimens of the Killarney plant, on which the var. Wilsoni was originally founded. It seems to be a much larger plant than the Dublin Canal one. Mr. Newman describes a stem which he believes to be of average size, and says it is 38 inches long, one-third of which was submerged, and from his figure of it, it must have been as thick as a goose-quill. He considers the average number of furrows as 10, "the ridges between them being broad, as in the common form, but the silicious particles are far less prominent, so that the plant does not partake of that asperity which so eminently characterises E. hyemale, E. Mackaii, and the more usual forms of E. variegatum, but has a smoother feel like that of E. palustre. . . . The sheaths are scarcely larger than the stem, with which, in dried specimens, they appear perfectly concolorous, with the exception of a narrow sinuous black band at the summit of each." (Brit. Ferns, ed. ii. pp. 39, 40.) Mr. Newman considered that the Mucruss plant was not the same as that from the Dublin Canal and Kincardineshire.

E. variegatum, or at least the stouter forms of it, is liable to be confounded with E. trachyodon, but the sheaths of the latter are cylindrical and closely applied to the stem, and they have long subulate, rather rigid teeth. In E. variegatum the sheaths widen upwards, and then contract; the teeth are considerably shorter than in E. trachyodon, even in those cases in which they are gradually acuminated. It is very rarely that the whole sheath becomes black, as they so commonly do in E. trachyodon.

Small forms of E. palustre have sometimes been mistaken for E. variegatum, but that plant has the stem-ridges without a furrow on their back, and without the two distinct rows of silicious tubercles on the ridges, which like the spaces between them, are only transversely rugose; the furrows of the sheaths which correspond to the divisions between the teeth are deeper, and the portion between these furrows more convex and without a central furrow until near the apex, while the lateral furrows, which are distinct in E. variegatum, are wanting in E. palustre; the teeth of the sheaths in E. variegatum are usually much longer and sharper than in E. palustre, and the spike of the latter is not apiculate or mucronate.

The stems of E. variegatum are completely evergreen, and the spikes more frequently survive the winter in this than in the other Equiseta hyemalia, although it occasionally happens to them all; when it does so, the spike in spring becomes slightly exserted and paler in colour.

It seems probable that under the name E. hyemale, Linnæus included not only the plant usually called E. hyemale by modern botanists, but also all the forms of the Equiseta hyemalia (the section Hippochæte, *Milde*). The same view was taken by Mr.

Newman in 1842, in which year he published descriptions of the British Equiseta in the 'Phytologist,' though in the 2nd edition of his 'British Ferns,' published in 1844, he described E. Mackaii (E. trachyodon) and E. variegatum as distinct from E. hyemale; but he marked the names of these species with a dagger, thus indicating they were "species whose distinctness I do not consider to be at present clearly proved." Dr. Stenzel, in Cohn's 'Kryptogamen Fl. von Schlesien,' includes under E. hyemale as subspecies E. ramosissimum, *Desf.*, E. hyemale genuinum with its var. Schleicheri (Moorei) and E. variegatum, *Schleicher*; and certainly all these forms pass so insensibly into each other, that I feel much inclined to follow his example. Still there seem sufficient differences to divide the subdeciduous E. hyemale with its form Moorei from the truly evergreen British Equiseta. E. trachyodon should probably be considered as but a subspecies of E. variegatum, but I think it is more than a variety; the living plant looks much more distinct from the forms of E. variegatum than do dried specimens.

Variegated Horsetail.

EXCLUDED SPECIES.

EQUISETUM RAMOSUM. *Schleicher.*

Said by Schkuhr to grow in Wales, but no authority is given. This is the plant now generally called E. ramosissimum, *Desf.* It occurs in the West of France, as far north as the valley of the Loire, and may possibly occur in Britain, as it might be passed as a form of E. variegatum. I have seen no Welsh specimens of E. variegatum, though it is reported from Carnarvon.

CLASS II.—**CELLULARES.**

Perennial or more rarely annual herbs which have a stem composed wholly of cellular tissue, producing adventitious roots and usually leaves or branches, more rarely reduced to that combination of stem and leaf termed a thallus, as in the Class III. (Thallophyta). Spores produced after fertilisation of the archegonia by the antherozoids, either solitary within a spirally marked indehiscent nucule, or numerous and contained in a spore case (*capsule* or *sporogonium*), which is usually elevated on a stalk. Antherozoids contained in the cells of coiled filaments or oblong vesicles, and discharged by the rupture of the cells.

ORDER XCVI.—**CHARACEÆ.***

Aquatic annual or perennial herbs having branched stems, of which the internodes consist of a single large cell, which is either naked or covered by a layer of slender parallel cortical-cells, and frequently coated with a deposit of carbonate of lime. Stems furnished at the nodes with whorls of branchlets (leaves of many authors). At the base of the verticillate branchlets there are in many species two or more whorls, rarely only one whorl of stipule-cells (*involucral spines*, Babington—*stipulodes* of Messrs. Arthur Bennett and H. and J. Groves). Branchlets simple, or one or more times forked into rays, or with partial or rarely complete whorls of secondary branchlets (*bracts*). Male and female organs developed at the extremity of the branchlets, or at their nodes in the axils of the bracts. Male organs (*globules*) spherical, at first green, afterwards red or yellowish, consisting of 8 plates or shields, on the inside of each of which there is a central projecting cell, termed the *manubrium*, terminated by a globular cell, called the *capitulum*, or head, which produces 6 secondary *capitula*, or heads, from each of which proceed four long coiled filaments divided transversely into very numerous cells, in each of which is formed a biciliated antherozoid. Female organs (*nucules*) subglobular or ovoid or fusiform, reddish-yellow or olive, consisting of a nucleus coated with five cells coiled spirally round it, terminated by a *coronula*, or crown, of 5 prominent cells in 1 row, or of 10 less prominent ones in two superposed rows. The apical cell of the nucleus is fertilised by the antherozoids; ultimately the nucule falls and germinates, [producing two shoots, one of which descends into the soil, produces root-hairs, and remains colourless, constituting the primary *rhizoid*; the other shoot ascends, and soon develops chlorophyll; its longitudinal growth is limited to a few cells, but at about its middle or below, a bud is formed, from which the perfect plant is developed: sometimes two or more rhizoids, and two chlorophyll-bearing shoots are produced from the same nucule. See Plate 1905, and A. de Bary in 'Botanische Zeitung,' 1875, p. 377, t. v. and vi.] *

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* In the general arrangement and nomenclature of the species of this Order, I have followed the eighth edition of Babington's 'Manual of British Botany,' pp. 468 and 473. The admirable papers of Messrs. H. and J. Groves in 'Journal of Botany,' 1880, have given me much assistance, especially by quoting synonyms from works to which I had not access, and giving the localities, so far as known, in which the species occur.

GENUS I.—**NITELLA.** *Agardh.*

Internodes of the stem more or less pellucid, naked, without a covering of parallel cortical cells, also without a whorl of stipule-cells below the whorl of branchlets. Nucule with a crown of 10 small erect cells in 2 superposed rows, the cells of the upper row much smaller than those of the lower row, generally falling off before the nucule is ripe.

SECTION I.—EU-NITELLA. *A. Braun.*

Globules in the forks of the branchlets, of which the terminal rays are either 1-celled, or, if of more than 1 cell, having the apical cell much smaller than that behind it. Nucules below the globules.

SPECIES I.—**NITELLA FLEXILIS.** *Agardh.*

PLATE 1899.

Braun, *Rabenhorst*, and *Stizinger*, Char. Europ. Exsicc. Nos. 22, 23, 24, 54, 55, 101.
Nordstedt and *Wahlstedt*, Char. Scand. Exsicc. Nos. 8–14.
Nitella flexilis, *Agardh*, Syst. Alg. p. 124. *Groves* in Journ. Bot. 1880, p. 166, t. 210,

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* Owing to the indisposition of Mr. Boswell, the task of bringing the Characeæ down to date, and seeing this portion of ENGLISH BOTANY through the press, has been entrusted by the publishers to myself; and in order that it may be known what portions I am responsible for, everything that I have added to Mr. Boswell's work is included in square brackets thus [ ], with the exception of the bulk of the synonymy for which I am chiefly responsible, some additional localities, and a few words it has been necessary to add or alter here and there in order to make the context clearer; beyond this, the work stands just as Mr. Boswell left it.—N. E. Brown, Herbarium, Kew, Surrey.

f. 18. *Kütz*, Phyc. Gener. p. 318; Phyc. Germ. p. 256; Sp. Alg. p. 514; and Tab. Phyc. Vol. VII. p. 13, t. 32, f. ii. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 261.* *A. Braun*, Schweizer Char. p. 8; Conspectus Char. Europ. p. 2; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 397; and Fragm. Monogr. Char. p. 34. *Wahlst.* Bidr. Skand. Char. 1862, p. 4; and Monog. Sver. Norg. Char. p. 16. *Babing.* Man. ed. 8, p. 468. *Crepin*, in Bull. Soc. Bot. Belg. Vol. II. p. 129. *Leonhardi*, in Brunn Verhandl. Vol. II. p. 168. *Müller*, in Bull. Soc. Bot. Genève, 1881, p. 51. *Allen*, Char. Amer. pp. 9–12, pl. 4 and 5. *Sydow*, Europ. Char. p. 17.

N. Brongniartiana, *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 682; and Atlas, pl. 40, f. c; ed. ii. p. 896; and Atlas, pl. 46, f. D.

N. furculata, *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 35.

Chara flexilis, *Linn.* Sp. Pl. ed. i. p. 1157 (partly). *Canterer*, Österr. Char. p. 8. *Bischoff*, Krypt. Gewächse, p. 26, t. 1, f. 1–3; and Handb. Bot. Term. und Syst. t. 57, f. 2802–2804, and 2809. *Bruzel.* Obs. Char. pp. 15 and 23. *A. Braun* in Flora, 1835, Vol. I. p. 50. *Schkuhr*, Bot. Handb. t. 280. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 83. *Reichenb.* Iconog. Vol. VIII. p. 37, t. 795.

C. Brongniartiana, *Wedd.* in *Coss. Germ.* and *Wedd.* Cat. rais. Pl. Vasc. Envir. Par. p. 152.

"C. furculata, *Reich.* in *Mössl.* Handb. ed. iii. Vol. III. p. 1664."

C. commutata, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 9; and Symb. ad Hist. Plant. Ross. p. 77.

Monœcious. Dull dark green or olive. Stem slender, translucent, without cortical cells or spine-cells or stipule-cells. Branchlets usually 6 (more rarely 7 or 8) in a whorl, forked or more rarely trifid, with acute but not mucronate 1-celled points and rays. Primary whorls always lax; those of the secondary whorls similar and more compact (when it is the form subcapitata of Braun and C. nidifica of collectors, according to Babington). Nucules solitary, rarely in pairs, produced at the angle between the rays of the branchlets, without bracts, accompanied by a globule, which is placed above them, subglobular-ovoid, 7- or 8-striate ("8- or 9-striate," Groves), with a minute deciduous crown. In ponds and pools and ditches, rare.

Amberley, Sussex; Kent; Wimbledon Common, Surrey; Essex; Herts; Cambridge; Warwick; York; Northumberland; Suffolk; Lancashire; Kirkcudbright; Perth; Lough Allen, Leitrim.

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* [The title-page of this volume runs thus :—"Kongl. Vetenskaps-Akademiens nya Handlingar för år, 1852. Stockholm, 1854." But Wallman's paper on Characeæ was presented to the Society in April 1853, and a separately paged extract of it was published in 1853, therefore, although it has been thought advisable to quote the volume as for 1854 (the volumes of this Journal not being numbered), the real date of publication of Wallman's monograph is 1853. A French translation by Dr. Nylander was published in 1854.]

I have seen neither Scotch nor Irish specimens, but Professor Babington and Messrs. Groves have it from both these countries.

England, Scotland, Ireland. Perennial. Summer.

Stems slender, flexible, 6 to 18 inches long or more; "often annularly encrusted" (Groves). Branchlets ½ inch to 2 inches long; nucules minute, yellowish, ultimately black.

[The variety *crassa* (Braun, Rabenh. and Stiz. Exsicc. No. 101), distinguished from the type by its greater stoutness and shorter terminal segments; and variety *nidifica* (Wallm. in Kongl. Vet. Akad. Handl. Stockh., 1854, p. 262), which has the sterile branchlets often simple, and the fertile branchlets very short and collected into compact heads;—are stated by Messrs. H. and J. Groves (Journ. of Bot., 1883, p. 22), both to have been found in Perthshire; the former in Watson Loch, Doune, and Marlee Loch; the latter in Marlee Loch.]

There can be little doubt that the name "flexilis" was intended by Linnæus to include under it other forms besides the present, and it would have been much better to have adopted some later but more specially applied name; but "flexilis" is now in general use, so that little confusion is likely to occur.

Flaccid Nitella.

SPECIES II. (?) NITELLA SYNCARPA. *Chevallier.*

PLATE 1900.

Diœcious. Bright green or olive. Stem slender, translucent, without cortical cells or spine-cells or stipule-cells. Branchlets usually 6 (more rarely 7 or 8) in a whorl; those of the primary whorls in the male plant elongated and forked or trifid, in the female simple, forked or trifid, with acute but not mucronate 1-celled rays. Primary whorls always lax; those of the secondary whorls usually more compact, and in the female plant always so, often so short as to appear capitate. Nucules 2 or 3, rarely 4, at the middle of the simple branchlets, or in the angle between the rays when they are forked, without bracts, subglobular-ovoid, 5- or 6- (rarely 7-) striate, with a minute deciduous crown. Globules at the angle between the rays of the branchlets.

Var. α. *genuina.*

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. No. 76.
Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 1a, 1b, and 2.

Nitella syncarpa, *Chevallier*, Flor. Gen. ed. ii. Vol. II. p. 125. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 35. *Kütz.* Phyc. Germ. p. 256; Sp. Alg. p. 514; and Tab. Phyc. Vol. VII. t. 31, f. ii. *Wahlst.* Bidr. Skand. Char. p. 9; and Monog. Sver. Norg. Char. p. 14. *Babing.* Man. ed. 8, p. 469. *A. Braun*, Consp. Char. Europ. p. 1; Schweiz. Char. p. 6; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 396; and Fragm. Monog. Char. p. 30, t. v. f. 101–103. *Coss. & Germ.* Fl. Envir. Par. ed. ii. p. 894; and Atlas, pl. 45, f. A. *H. & J. Groves* in Journ. Bot. 1880, p. 167. *Leonhardi* in Brunn, Verhandl. Vol. II. p. 167. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 48. *Sydow*, Europ. Char. p. 10.

Nitella syncarpa, var. leiopyrena, *A. Braun*, Schweiz. Char. p. 7.

N. syncarpa, var. capitata, *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 682; and Atlas, pl. 39, f. 1–6.

Chara syncarpa, *A. Braun* in Flora, 1835, Vol. I. p. 51. *Ganterer*, Österr. Char. p. 9. *Reichenb.* Iconog. Vol. VIII. t. 797 ? and 798.

Green. Branchlets of the female plant simple, those of the axillary branches less large, and often collected into small glomerules. Nucules covered with mucilage, placed about the middle of the simple branchlets, with 6 to 8 striæ, and with the spiral ridges on the central cell scarcely prominent. Globules covered with mucus, solitary in the forks of the rays, generally on the axillary branches, crowded into compact glomerules, from the branchlets being extremely short.

Var. *β. capitata.* Kützing.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 26, 27, 28, and 104.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 3 and 4.

Nitella capitata, *Agardh*, Syst. Alg. p. 125. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 34. *Kütz.* Phyc. Gener. p. 319. *Wahlst.* Bidr. Skand. Char. p. 8; and Monog. Sver. Norg. Char. p. 15. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 265. *Babing.* Man. ed. 8, p. 469. *A. Braun*, Consp. Char. Europ. p. 1; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 396; and Fragm. Monog. Char. p. 31. *H. & J. Groves* in Journ. Bot. 1880, p. 167. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 130. *Leonhardi* in Brunn, Verhandl. Vol. II. p. 166. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 49. *Sydow*, Europ. Char. p. 12.

N. syncarpa, vars. *β* capitata and *γ* glœocephala, *Kütz.* Phyc. Germ. p. 256.

N. syncarpa, vars. capitata and oxygyna (a misprint for oxygyra !), *A. Braun*, Schweiz. Char. p. 7.

Chara capitata, "*Nees ab Esenb.* in Denkschr. d. Bot. Gesellsch. Vol. II. (1818), p. 80, t. 6," teste *Braun.* *Bruzel*, Obs. Char. p. 24.

C. syncarpa var. *Reichenb.* Iconog. Vol. VIII. t. 799, f. 1076, 1077.

C. syncarpa, var. capitata, *Ganterer*, Österr. Char. p. 9.

C. elastica, *Amici*, Descriz. Chara, p. 9, t. 1, f. 2–3, and t. 2.

Green or light olive. Branchlets of the female plant forked or trifid, those of the axillary branches usually collected into small glomerules. Nucules covered with mucilage, placed in the angles between the branchlets and the rays, with 6 or 7 striæ, and with the spiral ridges on the central cell very prominent and acute. Globules covered with mucilage, solitary in the forks of the rays, mostly on axillary branchlets and crowded into small compact glomerules or heads, from the branchlets being extremely short.

Var. γ. *opaca.* Kützing.

PLATE 1900.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 29, 51, 52, 53, 77, 105, 106.
Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 5a, 5b, 6a, 6b, 7.
Nitella syncarpa, var. opaca, *Kütz.* Phyc. Germ. p. 256.
N. syncarpa, vars. opaca, glomerata, and pachygyra, *A. Braun*, Schweiz. Char. p. 7.
N. opaca, *Agardh*, Syst. Alg. p. 124. *A. Braun*, Consp. Char. Europ. p. 1; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 397; and Fragm. Monog. Char. p. 32. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 34. *Wahlst.* Bidr. Skand. Char. p. 6; and Monog. Sver. Norg. Char. p. 15. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 264. *Coss. & Germ.* Fl. Envir. Par. ed. ii. p. 895; and Atlas pl. 45, f. B. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 129. *Leonhardi* in Brunn, Verhandl. Vol. II. p. 165. *H. & J. Groves* in Journ. Bot. 1880, p. 166, t. 210, f. 19. *Babing.* Man. ed. 8, p. 469. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 50. *Sydow*, Europ. Char. p. 14.
N. atrovirens, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 263.
N. pedunculata, *Agardh*, Syst. Alg. Introd. p. xxvii.
Chara opaca, *Agardh* in *Bruzel.* Obs. Char. pp. 16 and 23.
C. flexilis, *Sm.* Engl. Bot. No. 1070.
C. syncarpa, *Thuill.* Fl. Envir. Par. p. 473. *Ganterer*, Österr. Char. p. 9. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 83.
C. syncarpa, vars. opaca and pseudoflexilis, *A. Braun* in Flora, 1835, i. p. 52.
C. syncarpa, var. Smithii, *Coss. Germ. & Wedd.* Cat. rais. Pl. Vasc. Envir. Par. p. 151. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 682; and Atlas, pl. 39, f. 7-12.

Olive. Branchlets of the female plant simple, forked or trifid; the primary are mostly barren, those of the axillary branches collected into rather large, lax glomerules. Nucules not coated with mucilage, placed in the angles between the branchlets and the rays, with 5 or 6 striæ, and with the spiral ridges on the central cell rather prominent and blunt. Globules not covered with mucilage, in the forks of the rays, mostly on axillary branches, concealed in rather large lax glomerules, from the branchlets being only moderately short.

In lakes, ponds, pools, and ditches.

Var. α.—Not known to occur in Britain, but very likely to be detected, as it occurs in the north of France.

Var. *β.*—Professor A. Braun referred to this var. specimens in the Kew Herbarium, from Kent; Llyn Idwal, Carnarvon; and Killarney, Kerry.

Var. *γ.* — Common and generally distributed in England and Scotland, in which it is known to occur northwards to Caithness and Orkney. From south to north of Ireland.

England, Ireland, and Scotland. Annual or perennial.
Spring and "Summer."

The var. opaca, which is considered a distinct species by Braun and others, is a variable plant 6 inches to 2 feet long, the branchlets ½ to 2 inches long; both in the male and female plant, but especially in the latter, the fertile branches are usually so short that the globules and nucules seem to be produced in heads, though occasionally two or three nucules may be found at the forks of elongate branches. The colour of the plant is usually dull olive, sometimes dark olive, and it not unfrequently has the stem coated with carbonate of lime, generally in rings, but sometimes continuously. It is so like N. flexilis that in a barren state it is extremely difficult, sometimes impossible, to discriminate between them, as the fact of the latter being monœcious is not then observable. I have little doubt that the two ought to be considered as at best but subspecies.

The typical N. syncarpa and N. capitata are both usually more slender and of a brighter green colour than N. opaca; the heads are smaller, and the nucules and globules are described as surrounded by mucilage, a character which is not easily distinguishable in dried specimens [unless held obliquely to the light and viewed under a lens].

According to Cosson and Germain, N. syncarpa (genuina) germinates in spring and fruits in the end of summer or autumn; N. capitata germinates in autumn and fruits in spring; while N. opaca fruits from May to July. In the pond at Balmuto it fruited in April and appeared to be perennial. In an aquarium globe it lived two years, but never fruited.

[Of Ch. syncarpa, Thuill., there exists in the Kew Herbarium an authentic specimen from Thuillier, obtained from Gay's Herbarium, labelled "Chara syncarpa, Thuill. Fl. Par. 473. Lois. Fl. Gall. II. p. 623.—Thuillier 1812." Wallroth, who saw this specimen in 1828, named it "Chara flexilis, L.;" and A. Braun in Sept. 1834 has labelled it "Chara syncarpa, Thuill. (specimen ab auctore!) apices foliorum a forma communi paulo recedunt (Ch. syncarpa pseudoflexilis)." An examination of this specimen shows that it is somewhat intermediate in character between the plants now called N. syncarpa and N. opaca, having more the appearance and dark colour of some states of N. opaca; the specimen is female, and the branchlets are simple, no traces of mucilage, so characteristic of N. syncarpa, are visible on the globules and nucules, and the spiral ridges on the nucleus of the nucules are less prominent and acute than in N. opaca, and more so than in N. syncarpa, though no doubt this is a variable character, and one which Messrs. Groves seem to have misunderstood, as they describe the nucules (under N. capitata) as having "sharp prominent cells," but the spiral cells of the nucules are not more prominent in N. capitata than in N. syncarpa, and are not sharp, but rounded as in other Characeæ; the terms *oxygyra*, *pachygyra*, &c. used by A. Braun, refer to the ridges on the nucleus *between* the spiral cells, which correspond to the striæ on the surface of the nucule, and are not cells, but merely thickened portions of cell-walls. Of the specimens at Kew referred by Braun to N. capitata, the Llyn Idwel plant (C. gracilis, *Wilson* in *Hook*. Bot. Miscell. vol. i. p. 336; not of Sm.) has traces of mucilage, and seems rather to belong to N. syncarpa, as the nucleus of the nucule is broader, and the ridges on it are not nearly so prominent and sharp as in typical N. capitata; the Kent specimen has no mucilage, and is simply the ordinary N. opaca, which is doubtless but a sexual state of N. flexilis, for taking the whole of the forms of N. flexilis and N. opaca there is nothing to distinguish the two but sex, which is not a specific character, and N. flexilis may be regarded as a polygamous species, with male, female, and hermaphrodite plants. The Killarney specimens in size and general appearance resemble the Llyn Idwel plant, but there are no traces of mucilage on them, and except in being smaller are not distinguishable from some specimens collected at Lyndhurst, and distributed by Messrs. Groves as N. opaca (No. 86). N. opaca var. attenuata described by Messrs. Groves in Jour. Bot. 1881, p. 356, is a striking form found at Hythe, S. Hants, with long and very slender branchlets, but still is evidently only a slender state of their Lyndhurst plant, and except that there is no mucilage on the globules and nucules, it is identical with N. syncarpa of Nordstedt and Wahlsted's Char. Scand. Exsicc. No. 2 (a form well figured in Reichenbach's Iconographia, vol. viii. pl. 798), which fact would seem to imply that the presence or absence of mucilage is of doubtful value as a specific character.—N. E. B.]

Twin-fruited Nitella.

SPECIES III.—NITELLA TRANSLUCENS. *Agardh.*

PLATE 1901.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. No. 19.

Nordst. & Wahlst. Char. Scand. Exsicc. No. 81.

Nitella translucens, *Agardh*, Syst. Alg. p. 124. *A. Braun*, Consp. Char. Europ. p. 2; and Fragm. Monog. Char. p. 49. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 682;

and Atlas pl. 40, f. B; ed. ii. p. 895; and Atlas pl. 46, f. c. *Kütz.* Phyc. Gener. p. 318; Sp. Alg. p. 513; Tab. Phyc. Vol. VII. p. 10, t. 26, f. i. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 259. *Wahlst.* Bidr. Skand. Char. p. 2; and Monog. Sver. Norg. Char. p. 17. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 36. *Crepin*, in Bull. Soc. Bot. Belg. Vol. II. p. 128. *Leonhardi* in Brunn, Verhandl. Vol. II. p. 173. *H. & J. Groves* in Journ. Bot. 1880, p. 165, t. 210, f. 17. *Babing.* Man. ed. 8, p. 469. *Sydow*, Europ. Char. p. 19.

Chara translucens, *Persoon*, Syn. Vol. II. p. 531. Sm. Engl. Bot. No. 1855. *Loisel. Deslong.* Notice, p. 135. *Bruzel.* Obs. Char. p. 22. *A. Braun* in Flora, 1835, Vol. I. p. 50. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 84.

Chara flexilis, *Thuill.* Fl. Envir. Par. p. 472; not of Linn.

Monœcious. Bright shining green. Stem rather stout, pellucid, without cortical cells or spine-cells or stipule-cells. Branchlets 4 to 8 in a whorl; those of the primary whorls barren, elongated, rather stout, obtuse, simple, or with 1 or more terminal rays, so short that they are reduced to little more than points, some of them elongated and bearing secondary fertile whorls, with extremely short trifid branches, giving the appearance of forming small heads or interrupted spikes. Nucules 2 to 3, immediately below the 3 rays of the fertile branchlets, subglobular-ovoid, 5- to 7-striate, with a minute deciduous crown. Globules solitary, terminating the fertile branch, and surrounded by its 3 short rays immediately above the nucules.

In stagnant water, but usually where there is considerable depth, rarely in streams. Rather rare, but occurring in many places in the south of England; rare in Scotland, where it occurs in Lochnaw, Wigtonshire; neighbourhood of Edinburgh; Kinghorn, Fife; Loch Leven, Kinross; Loch Lubnaig, Perthshire; Loch of Drum, Aberdeenshire. In Ireland it is reported from Kerry, Galway, Antrim, and Derry.

England, Scotland, Ireland. Perennial. Summer.

N. translucens is perhaps the finest of the British Characeæ from the bright green colour and large size, being 1 to 4 feet long or more, with much stouter stems than any of the other Nitellæ. It is well distinguished by the rays of the barren branchlets being so reduced as to form mere papillæ at the end of those branches where they occur. The fertile whorls are so reduced that they look something like the spikes of Potamogeton pusillus.

Translucent Nitella.

SPECIES IV.—NITELLA MUCRONATA. *Cosson & Germain.*

PLATE 1902.

Braun, Rabenh. & *Stiz.* Char. Europ. Exsicc. Nos. 17–20, 30.

Nordst. & *Wahlst.* Char. Scand. Exsicc. No. 82.

Nitella mucronata, *Coss.* & *Germ.* Fl. Envir. Par. ed. i. p. 683, and Atlas pl. 40, f. D; ed. ii. p. 896; and Atlas pl. 46, f. E, 1–3. *A. Braun*, Consp. Char. Europ. p. 2; Schweiz. Char. p. 9; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 398; and Fragm. Monog. Char. p. 50, t. i. f. 39–42. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 36. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 253. *Kütz.* Phyc. Germ. p. 256; Sp. Alg. p. 514; Tab. Phyc. Vol. VII. p. 13, t. 33, f. i. *Wahlst.* Monog. Sver. Norg. Char. p. 17. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 128. *Leonhardi* in Brunn, Verhandl. Vol. II. p. 172. *H.* & *J. Groves* in Journ. Bot. 1880, p. 165, t. 210, f. 16. *Babing.* Man. ed. 8, p. 469. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 52. *Sydow*, Europ. Char. p. 22.

N. exilis, *A. Braun*, Schweiz. Char. p. 9. *Kütz.* Sp. Alg. 515; and Tab. Phyc. Vol. VII. p. 13, t. 33, f. ii. (excluding syn. C. exilis, *Amici*).

N. flabellata, *Kütz.* Phyc. Gener. p. 318; and Phyc. Germ. p. 256. *Wallm.* in Kongl. Vet. Handl. Stockh. p. 249. *A. Braun* in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 398.

N. Norvegica and N. longifurca, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 252.

Chara mucronata, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 351; and in Flora, 1835, Vol. I. p. 52. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 84. *Ganterer*, Österr. Char. p. 9.

C. furcata, *Amici*, Descriz. Char. p. 14, t. v. f. 2, and t. 3, f. 2 (not of *Roxb.*).

C. Barbierii, *Bals. Crivelli* in Bibl. Ital. vol. 97, p. 190.

C. flexilis, *Reichenb.* Iconog. Vol. VIII. p. 38, t. 795, (not of other Authors).

C. flexilis, var. stellata, *Wallr.* Annus Bot. p. 178, t. vi. f. 1, 2.

C. longifurca, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefr. p. 10.

C. brevicaulis, *Bertol.* Fl. Ital. X. p. 19.

Monœcious. Green or olive. Stem rather slender, translucent, without cortical cells or spine-cells or stipule-cells. Branchlets 4 to 8 in a whorl, slender, most of them 2 or 4 times bi- or tri- or quadrifurcate; the ultimate divisions shorter than the lower, often of 2 cells and sharply mucronate; those of the primary whorls rather lax and with elongated segments; those of the secondary whorls similar or short, sometimes so much so as to give the appearance of forming heads. Nucules solitary, immediately below the upper forks of the rays of the branchlets, subglobular-ovoid, 5- or 6-striate, with a minute deciduous crown. Globules solitary between the forks of the branchlets, immediately above the nucules.

In still water, very rare; marsh ditch at West Grinstead, Sussex, (Mr. Borrer); water-hole by the River Ouse, near Bedford (A. H. Davies, and J. Saunders).

England. Annual. Summer, Autumn.

Stems 6 inches to 1 foot long; primary branches ¼ to 2 inches long. N. mucronata has sometimes much the habit of N. flexilis, but may be distinguished by its more divided branches, of which the ultimate rays are often 2-celled and tipped with a small conical cell or mucro.

I have not seen Mr. Borrer's specimens of this plant, but Messrs. Groves state that it is near the var. *heteromorpha*, Braun [figured in Bischoff, Handb. Bot. Term. und Syst. t. 57, f. 2811], and this is shown by the figure they give of it, which was drawn from Mr. Borrer's specimen. Var. heteromorpha is the name given to the form in which the secondary whorls are contracted, and not lax like the primary ones.

Mucronate Nitella.

SPECIES V.—**NITELLA GRACILIS.** *Agardh.*

PLATE 1903.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 24, 25, 57, 58, 59.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 15, 16, 17.

Nitella gracilis, *Agardh*, Syst. Alg. p. 125. *Braun*, Consp. Char. Europ. p. 2; Schweiz. Char. p. 10; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 399; and Fragm. Monog. Char. p. 58. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 683; and Atlas pl. 41, f. E; ed. ii. p. 897; and Atlas pl. 47, f. F. *Kütz.* Phyc. Germ. p. 256; Phyc. Gener. p. 319; Sp. Alg. p. 515; and Tab. Phyc. Vol. VII. p. 14, t. 34, f. i. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 38. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 128. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 247. *Leonhardi* in Brunn Verhandl. Vol. II. p. 170. *Wahlst.* Bidr. Skand. Char. p. 1; and Monog. Sver. Norg. Char. p. 19. *H. & J. Groves* in Journ. Bot. 1880, p. 164, t. 210, f. 15. *Babing.* Man. ed. 8, p. 469. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 52. *Sydow*, Europ. Char. p. 25.

Chara gracilis, *Sm.* Engl. Bot. No. 2140. *Bruzel.* Obs. Char. pp. 17 and 24. *Bischoff*, Hand. Bot. Term. und Syst. t. 57, f. 2810. *Reichenb.* Iconog. Vol. VIII. p. 36, t. 793. *A. Braun* in Flora, 1835, Vol. I. p. 53. *Ganterer*, Österr. Char. p. 10, t. i. f. ii. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 84.

C. exilis, *Barbieri* in *Amici*, Descriz. Char. p. 20, t. iii. f. vi.

Monœcious. Bright green. Stem slender, pellucid, without cortical cells or spine-cells or stipule-cells. Branchlets 4 to 7 in a whorl, capillary, most of them 2 to 3 times bi- or tri- or quadrifurcate, the ultimate divisions shorter than the lower, often of 2 cells, sharply mucronate, those of the primary whorls rather lax and with elongated segments, those of the secondary whorls similar and also lax. Nucules solitary immediately below all the forks of the rays of the branchlets, subglobose, 6- to 7-striate, with a very minute deciduous crown. Globules solitary between the forks of the branchlets, immediately above the nucules.

In boggy pools and ditches, very rare.

In St. Leonard's Forest, Sussex, found by Mr. Borrer, from which station it was described by Smith. Messrs. Groves state that "it has since been collected by Mr. D. Orr, at Glen Cullen, near Ballybetagh, co. Dublin," by Mr. Nicholson, at Kingston, Surrey; and by Mr. Beckwith, in Shropshire.

England, Ireland. Annual. Autumn.

A very delicate plant, usually 3 to 6 inches long; but the form *elongata* of Braun, Rabenh. and Stiz. Char. No. 58 is more than a foot. Rays of the primary whorls $\frac{1}{4}$ to $\frac{1}{2}$ inch long, much divided, with the segments as delicate as the filaments of a Conferva; secondary whorls similar, but shorter. Sometimes, however, the plant has thicker stems and branchlets, and the secondary whorls much denser, as in the form *bugellensis*, Braun, Rabenh. and Stiz. Char. No. 25, which seems to me to come very near Nitella mucronata, var. δ. 17 of the same set, and to be dissimilar to the typical and elongated states represented by Nos. 24, 57 and 58. I have seen neither English nor Irish specimens; the Irish is described by Messrs. Groves as a "smaller, stouter form, and the ultimate rays are shorter, and it is annularly incrusted." Messrs. Groves describe the nucules "as 6- or 7-striate," but those I have examined have been mostly 7-striate. Coss. and Germ. say they are with 4 or 5 striæ, and that the fructification takes place in April and May and in autumn.

Slender Nitella.

SPECIES VI.—NITELLA TENUISSIMA. *Kutzing.*

PLATE 1904.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 60, 103.

Nordst. & Wahlst. Char. Scand. Exsicc. No. 41.

Nitella tenuissima, *Kütz.* Phyc. Gener. p. 319; Phyc. Germ. p. 256; Sp. Alg. p. 515; and Tab. Phyc. Vol. VII. p. 14, t. 34, f. ii. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 683; and Atlas pl. 41, f. F; ed. ii. p. 898; and Atlas pl. 47, f. G. *Braun,* Consp. Char. Europ. p. 2; Schweiz. Char. p. 10; in *Cohn,* Krypt. Fl. Schles. Vol. I. p. 399; and Fragm. Monog. Char. p. 62. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 246. *Leonhardi* in Brunn Verhandl. Vol. II. p. 169. *Wahlst.* Monog. Sver. Norg. Char. p. 19. *H. & J. Groves* in Journ. Bot. 1880, p. 163, t. 209, f. 14. *Babing.* Man. ed. 8, p. 469. *Müller* in Bull. Bot. Genève, 1881, p. 53. *Sydow,* Europ. Char. p. 28. *Allen,* Char. Amer. p. 13, pl. vi.

N. hyalina, *Agardh,* Syst. Alg. 126 (teste *Bab.*). Non *DC.*

Chara tenuissima, *Desv.* in Journ. de Botanique, 1809, Vol. II. p. 313. *Loisel. Deslong.* Notice, p. 136. *Bischoff,* Handb. Bot. Term. und Syst. t. 57, f. 2812. *Ganterer,* Österr. Char. p. 10, t. 1, f. i. *Reichenb.* Iconog. Vol. VIII. p. 36, t. 791, 792. *A. Braun* in Flora, 1835, Vol. I. p. 53. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 85.

Monœcious. Dark green. Stems capillary, pellucid, without cortical cells or spine-cells or stipule-cells. Branchlets 5 to 8 in a whorl, most of them 3 to 7 times bi- or tri-furcate, the ultimate divisions longer than the lower, 2-celled and longly mucronate, those of all the whorls very compact with short segments, so that the whorls resemble widely separated heads which are mucilaginous and generally encrusted. Nucules solitary immediately below all the forks of the rays of the branches, ovoid, 7- to 9-striate with a very minute deciduous crown. Globules solitary between the forks of the branchlets immediately above the nucules.

In fen ditches and pits, very rare. In Roydon Fen, Norfolk; Bottisham, Wicken, and Burwell Fens, Cambridgeshire; Anglesea, (J. E. Griffith); first found by Professor Henslow in 1829.

England, Wales. Annual. Summer, Autumn.

A very elegant species, usually 2 to 3 inches high, primary branches $\frac{1}{12}$ to $\frac{1}{6}$ inch long, whorls usually $\frac{1}{4}$ to $\frac{1}{2}$ inch apart, but sometimes less. I have a fine series of specimens of this, collected in Burwell Fen by Dr. J. A. Power, and one from Bottisham Fen collected by Mr. C. A. Stevens in May, 1838.

N. tenuissima comes near to N. gracilis, but is much smaller, and very different in appearance from the extreme shortness of the branches, though it is difficult to find any marked distinction between them. The terminal or mucro cell of the ultimate rays of the branchlet is longer in proportion and more gradually tapering than in N. gracilis.

Dwarf Nitella.

SECTION II.—TOLYPELLA. *A. Braun.*

Globules on the inner side of and at the first node of branchlets, accompanied by 2 to 4 bracts, similar to the branchlet but shorter and generally unequal. Nucules surrounding the globule.

SPECIES VII.—**NITELLA GLOMERATA.** *Chevallier.*

PLATES 1905 AND 1906.

Monœcious (or rarely diœcious ?). Pale or dark olive. Stem rather stout, transparent or much more commonly opaque from being thickly encrusted with carbonate of lime, without cortical cells or spine-cells or stipule-cells. Branchlets 6 to 12 in a whorl, those of the primary whorls sterile, of 3 to 5 cells, obtuse, unbranched; fertile whorls terminating the stems, and primary and secondary branches, forming rather large, oblong-ovoid or oval-ovoid heads consisting of the numerous branchlets and incurved bracts; branchlets 3- to 5-celled, obtuse, bearing at the first node 3 or 4 lateral bracts, each bract of 3 or 4 cells, obtuse, similar to the terminal portion of the branchlet, but shorter and incurved over the nucules and globule. Nucules 2 to 5 together, at the nodes of the fertile branchlets, between the bracts, oval-ovoid, 8- to 9-striate, with a minute deciduous crown. Globules solitary, lateral on the inner side of the fertile branches between the bracts, surrounded by the nucules.

Var. α. *genuina.*

PLATE 1905.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. No. 17 partly. *Nordst. & Wahlst.* Char. Scand. Exsicc. Nos. 43, 44, 45.

Nitella glomerata, *Chevallier*, Fl. Gen. ed. 2, Vol. II. p. 124. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 681; and Atlas pl. 41, f. H, excluding description under explanation of plate; ed. 2, p. 893. *Kütz.* Sp. Alg. p. 517. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 270. *A. Braun*, Consp. Char. Europ. p. 3. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 130. Fl. Danica, t. 2800. *Babing.* Man. ed. 8, p. 470.

N. glomerulifera, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 270. *Kütz.* Tab. Phyc. Vol. VII. p. 32, t. 81, f. ii. Not of *A. Braun.*

N. flexilis, var. glomerulifera, *Kütz.* Sp. Alg. p. 514.

Tolypella glomerata, *Leonh.* in "Lotos, 1863, p. 129;" and in Brunn, Verhandl. Vol. II. p. 176. *Wahlst.* Monog. Sver. Norg. Char. p. 22. *H. & J. Groves* in Journ. of Bot. 1880, p. 162, t. 209, f. 11. *A. Braun*, Fragm. Monog. Char. p. 95. *Sydow*, Europ. Char. p. 35.

Chara glomerata, *Desv.* in *Loisel. Deslong.* Notice, p. 135. *A. Braun* in Flora, 1835, Vol. I. p. 55. *Baker* in Report of London Bot. Exchange Club for 1867, p. 16; and in Journ. Bot. 1868, p. 73.

C. glomerulifera, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 9.

C. prolifera, *Babing.* in Ann. Nat. Hist. ser. ii. Vol. V. 1850, p. 87. Not of *A. Braun.*

Monœcious.

Var. β. *Smithii.*

PLATE 1906.

Nitella Smithii, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 271.

Chara Smithii, *Babing.* in Ann. Nat. Hist. ser. ii. Vol. V. 1850, p. 86.

C. nidifica, *Sm.* Engl. Bot. ed. i. No. 1703, principal figure. Not of *Roth.*

Diœcious? Only the male plant known.

In pools and ditches, particularly in brackish water, rare.

Var. α recorded from Devonshire, Hayling Island, Hants; Kent, Middlesex, Essex, Norfolk, Cambridgeshire, Lancashire, Huntingdonshire, Yorkshire, Anglesea, Forfarshire, and near Dublin. Originally found near Cley, Norfolk, by Mr. Dawson Turner, and Mr. Borrer, in 1806. Var. β at Lancing, Sussex, in 1804-5, by Mr. Borrer, who says [Suppl. to Engl. Bot. 1834, Vol. II., under No. 2762] it was found in a ditch "which I believe the tide never reaches."

England, Wales, Scotland, and Ireland. Annual, perennial.
Spring, early Summer.

Stems much branched, very brittle, light or dark olive, and transparent when not coated with carbonate of lime, as is generally the case, 3 inches to 1 foot long; barren branchlets ¾ to 2 inches long. Fertile heads about ½ inch long by ¼ inch across. [The nucules sometimes have the spiral investing cells prolonged above the nucleus or nut, into a short neck, as shewn in one of the nucules on our plate (1905), which was taken from the more robust specimen thereon represented, all the nucules of that plant being similar.]

Messrs. H. and J. Groves and MM. Cosson and Germain both cite No. 17 Braun, Rabenh. and Stiz. Char. Europ. Exsicc. But in my set No. 17 is Nitella mucronata var. tenuior, and there is no N. glomerata in the set at all. [This seems to be the case in some other sets.]

With regard to the plant called C. Smithii by Babington, the question of its identity with the ordinary form of N. glomerata must remain uncertain; all the other known species of the section Tolypella are monœcious, so it would be a curious circumstance if N. Smithii were really diœcious; yet Mr. Borrer was far too acute an observer, and far too correct, to be likely to make a mistake on the point. [I have very carefully examined Mr. Borrer's Lancing specimen, and only find globules upon it, not a trace of a nucule: this is therefore, I have no doubt, another case of a polygamous species, as in that of N. flexilis; see note under N. syncarpa var. opaca.—N. E. B.]

Clustered Nitella.

SPECIES VIII.—**NITELLA INTRICATA.** *Agardh.*

PLATE 1907 AND 1908.

Monœcious. Very pale olive. Stem rather stout, transparent or more commonly opaque from being thickly encrusted with carbonate of lime, without cortical cells or spine-cells or stipule-cells. Branchlets 6 to 20 in a whorl; those of the primary whorls sterile, of 3 to 5 cells, acute, usually with a few simple or once-branched, 3- or 4-jointed branchlets similar to the bracts of the fertile whorls, more rarely unbranched. Fertile whorls terminating the stems and primary and secondary branches, forming large subglobose heads, consisting of very numerous branchlets, and incurved bracts. Branchlets 3- to 5-celled, acute, bearing at the first node 4 or 6 lateral bracts, each bract of 3 or 4 cells attenuated and acute, similar to the terminal portion of the branches, but shorter, and incurved over the nucules and globule. Nucules 2 to 8 together at the nodes of the fertile branchlets between the bracts, [and at the base of the branchlets,] subglobose-ovoid, 8- or 9-striate, with a minute deciduous crown. Globules solitary, lateral on the inner side of the fertile branches, between the bracts, surrounded by the nucules, [and lateral at the base of the branchlets.]

Var. *a. genuina.*

PLATE 1907.

Braun, *Rabenh.* & *Stiz.* Char. Europ. Exsicc. Nos. 18, 33, 108.

Nordst. & *Wahlst.* Char. Scand. Exsicc. Nos. 46, 47, 48.

Nitella intricata, *Agardh*, Syst. Alg. p. 125 (excluding synonym C. flexilis, var. stellata, Wallr. and the plant quoted from the Baltic Sea). *Coss.* & *Germ.* Fl. Envir. Par. ed. ii. p. 893 ; and Atlas pl. 47, f. i. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 39. *Braun*, Consp. Char. Europ. p. 3. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 130. Fl. Danica, t. 2744. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 56. *Babing.* Man. ed. 8, p. 470.

N. fasciculata, *A. Braun*, Schweiz. Char. p. 11. *Kütz.* Sp. Alg. p. 517 ; and Tab. Phyc. Vol. VII. p. 14, t. 36.

N. polysperma, *Kutz.* Phyc. Gener. p. 318 ; and Phyc. Germ. p. 255. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 269.

N. glomerata, *Coss.* & *Germ.* Atlas Fl. Envir. Par. ed. i., as to description under explanation of plate 41, not as to figure.

Tolypella intricata, *Leonhardi* "in Lotos, 1863, p. 32 ;" and in Brunn, Verhandl. Vol. II. p. 175. *Braun* in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 400 ; and Fragm. Monog. Char. p. 99. *Wahlst.* Monog. Sver. Norg. Char. p. 22. *H.* & *J. Groves* in Journ. Bot. 1880, p. 163, t. 209, f. 13. *Sydow*, Europ. Char. p. 38.

Chara intricata, *Roth*, Catalecta Bot. Fasc. II. p. 125. *Baker* in Report of London Bot. Exchange Club for 1867, p. 15 ; and in Journ. Bot. 1868, p. 73.

C. fasciculata, *Amici*, Descriz. Char. p. 16, t. iv. f. iv. and t. v. f. iii.

C. polysperma, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 352 ; and in Flora, 1835, Vol. I. p. 56. *Ganterer*, Österr. Char. p. 12, t. i. f. iii. *Babing.* in Ann. Nat. Hist. ser. ii. Vol. V. 1850, p. 88.

Branchlets of the sterile whorls 6 to 14, once or twice branched with the divisions simple or again branched.

Var. *β. prolifera.*

PLATE 1908.

Nitella prolifera, *Kütz.* Phyc. Germ. p. 255. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 269. *A. Braun*, Consp. Char. Europ. p. 3. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 130. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 55. *Babing.* Man. ed. 8, p. 470.

N. fasciculata, var. robustior (printed "robuster" by a typog. error). *A. Braun*, Schweiz. Char. p. 12. *Kütz.* Sp. Alg. p. 517.

N. Borreri, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 271.

Tolypella prolifera, *Leonhardi* "in Lotos, 1863, p. 57;" and in Brunn, Verhandl. Vol. II. p. 176. *Braun* in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 401; and Fragm. Monog. Char. p. 97. *H. & J. Groves* in Journ. Bot. 1880, p. 162, t. 209, f. 12. *Sydow*, Europ. Char. p. 37.

Chara prolifera (*Ziz.* herb.), *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 352; and in Flora, 1835, Vol. I. p. 56.

C. Borreri, *Babing.* in Ann. Nat. Hist. ser. ii. Vol. V. 1850, p. 87; and Man. Brit. Bot. ed. iii. p. 421.

C. nidifica, *Borrer* in Suppl. to Engl. Bot. 1834, Vol. II. under No. 2762.

C. intricata, *β.* robustior, *Baker* in Report of London Bot. Exchange Club for 1867; and in Journ. Bot. 1868, p. 73.

Branches of the sterile whorls 6 to 20, very unequal, simple, more pointed than in var. *α*; the whole plant larger.

In ponds, canals, and ditches.—Var. *α* rare, and not persistent in its localities. In a ditch at Hempstead Wood, Essex, 1861 (Mr. G. Gibson); near Haslingfield (Prof. Babington, 1832), and Harston (A. Bennett), Cambridgeshire; "Livermere, near Bury St. Edmund's, Suffolk, C. R. Leathes" (Mr. Borrer); Brammingham, Bedfordshire (J. Saunders); Sedgefield, Durham (Rev. A. M. Norman); Dutton, North Yorkshire (Mr. T. Comber); Goole, S.W. Yorkshire (T. Birks); Durham and Dublin.—Var. *β* extremely rare. Found by Mr. Borrer, in 1827, in a marsh ditch near Brookside, Henfield, and in 1840 near Rye Farm, Henfield Level, Sussex; [and has since been found in Deeping Fen, Lincolnshire, by Mr. Beeby, who kindly sent living specimens, from which plate 1908 was drawn; and in Cambridgeshire and Huntingdonshire this year (1884), by Mr. Fryer. The plant collected by Mr. D. Moore in the grand canal, Glasnevin, Dublin, has been wrongly referred by Messrs. Groves to N. prolifera, it belongs to N. intricata, as the sterile branchlets are branched, and not simple as in the var. prolifera, which has not yet been found in Ireland.]

England, Ireland. Annual. Spring.

Very similar to N. glomerata, but larger, especially in the "bird's-nest-like" masses formed by the fertile whorls; these also are broader, so as to be almost spherical; usually about ½ inch in diameter, and have the bracts tapering and *acute*, as are also the branchlets of the barren whorls. The most important difference, however, seems to be in the shape of the nucules, which are much more globose in N. intricata than in N. glomerata.

Of var. prolifera I have seen no specimens, either British or foreign; except by its larger size, and *simple* barren branchlets, it seems undistinguishable from N. intricata.

Many-fruited Nitella.

EXCLUDED SPECIES.

NITELLA NIDIFICA. *Agardh.*

In the report of the Botanical Exchange Club for the year 1867, published in 'Journal of Botany' for 1868, at p. 73, Mr. Baker writes, " A plant gathered many years ago by Dr. Moore in Lough Neagh, and suspected by him at the time to be the true *Chara nidifica* of the Fl. Danica, may not unlikely prove to be really so. It has been submitted to Dr. Braun for his opinion, and his reply is, " Habitus et folia omnino *nidificæ,* sed seminibus minoribus magis contortis accedit ad *C. fasciculatum* (*intricatum*)." I do not know if Messrs. Groves have seen this plant, or if it has been found by any other botanist except the late Dr. Moore.

[Of the Lough Neagh plant mentioned above, there exists in the Kew Herbarium but one specimen, on which Prof. A. Braun has written as above quoted, and in his 'Fragmente Monographie Characeen,' p. 94, he writes of this specimen as follows (translation):—" Habit of the Baltic N. nidifica, the leaves of the fertile whorls incurved in the same manner and obtuse. Nucule smaller, more contorted, 10-gyrate, unripe, 0,46–0,48 mm. long, without the crown 0,43–0,44 mm. long, nucleus yellowish-green 0,30–0,35 mm. long." He also says that it is " a form which would seem best united with N. intricata and prolifera, or rather with N. glomerata."

A very careful examination of this specimen with N. nidifica and N. glomerata, however, has not corroborated what Braun has stated. A comparison under the microscope, side by side with typical specimens of N. nidifica from the Baltic, named by Professors Braun and Nordstedt, has failed to disclose the least difference between them. The nucules examined by Braun must have been quite immature ones, which are the most numerous on the specimen, but there are a few which appear to have attained their full growth, and these are neither smaller nor more contorted than those of N. nidifica, and appear to be only 7–8-striate as in N. nidifica, not 10-striate as stated; their shape also is globose or subglobose as in N. nidifica, and lastly the habit, colour, size, branching, obtuseness and number of the cells of the branchlets is exactly as in N. nidifica. From N. intricata and its var. prolifera it is at once distinguished by the very obtuse apical cell of its branchlets, besides which N. intricata has the sterile ones branched. It is very much nearer to N. glomerata from which it chiefly differs in its nearly globose nucule, which is about as broad as long, whilst in N. glomerata the nucule is ellipsoidal, being distinctly longer than broad, and often half as long again as broad; the branchlets and their rays, or bracts, are also rather more incurved and more obtuse than in N. glomerata, and more constricted at the nodes (this may be due to desiccation, although I do not think so, as all the specimens examined were moistened in water in the same manner). But for all this, it is questionable whether N. nidifica and N. glomerata are more than varieties of each other; but until the plant is refound in the British Isles and becomes better known, it appears better to treat it separately, therefore the synonymy of N. nidifica is given for the Lough Neagh specimen, and a description is added, taken *exclusively* from this specimen.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. No. 32.

Nordst & Wahlst. Char. Scand. Exsicc. Nos. 84, 85, 86A, 86B.

Nitella nidifica, *Agardh*, Syst. Alg. p. 125. *Kütz.* Phyc. Gener. p. 318; Phyc. Germ. p. 255; Sp. Alg. p. 517; and Tab. Phyc. Vol. VII. p. 14, t. 37, f. i. *A. Braun*, Consp. Char. Europ. p. 3.

N. Stenhammariana, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. p. 271.

Tolypella nidifica, *Leonhardi* in Brunn, Verhandl. p. 176 (footnote), and p. 214. *Wahlst.* Monog. Sver. Norg. Char. p. 21. *A. Braun*, Fragm. Monog. Char. p. 93. *Sydow*, Europ. Char. p. 34.

Chara nidifica, *Roth*, Catalecta, fasc. II. p. 126, note under C. intricata. *Bruzel.* Obs. Char. pp. 17 and 23 (excluding syn. C. nidifica, Sm.). *Baker* in Report of London Bot. Exchange Club for 1867, p. 16; and in Journ. Bot. 1868, p. 74. *Ruprecht* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritt. liefer. p. 8.

C. flexilis, var. nidifica, *Hartm.* Scand. Fl. ed. 4, p. 358. *Fries*, Summ. Veg. Scand. p. 60.

C. flexilis, var. marina, *Wahlenb.* Fl. Suec. p. 718 (partly).

C. flexilis, var. prolifera, *Wallroth*, Comp. Fl. Germ. Vol. II. p. 105 (partly).

C. Stenhammariana, *Wallm.* in Add. Liljeblad Svensk. Fl. ed. 3, p. 686.

Conferva nidifica, *Müller*, Fl. Danica, t. 761.

Monœcious. Dark olive? drying blackish. Stem moderately stout, unencrusted, without cortical cells or spine-cells or stipule-cells. Branchlets 6 to 8 in a whorl, those of the sterile whorls unbranched, of 3 to 5 cells, the terminal cell very obtuse (truncately-rounded); fertile whorls in dense heads, terminating the stem and branches, branchlets 3–5-celled, very obtuse, strongly incurved, bearing at the first node 3 or 4 simple lateral bracts, each bract of 3 to 5 cells, very obtuse, shorter than the terminal portion of the branchlet and like it strongly incurved. Nucules 3 to 4 together in the axils of the bracts, globose or subglobose, 7 to 8-striate, with a very minute crown. Globules solitary, surrounded by the nucules.

Lough Neagh, found by Mr. D. Moore in July, 1837. On the Continent N. nidifica grows in salt or brackish water, but this can scarcely be the case with the Irish specimen.

Ireland. Summer.

Stems branched, not coated with carbonate of lime, flexible, 3 to 4 inches long; sterile branchlets ¾ to 2 inches long. Fertile heads about ¼ inch in diameter.—N. E. B.]

GENUS II.—**CHARA.** *Agardh.*

Internodes of the stem subopaque (rarely pellucid), usually with a covering of slender parallel cortical cells [rarely naked], and generally furnished with one or two whorls of stipule-cells below each whorl of branchlets. Nucule with a crown of five erect or spreading cells in one row, persistent.

SECTION I.—LYCHNOTHAMNUS. *Ruprecht.*

Internodes of the stem naked, without a covering of parallel cells, but with a whorl of long stipule-cells at the base of each whorl of branchlets. Globule by the side of the nucule, within the bracts. Nucule with a crown of 5 minute cells.

SPECIES I.—**CHARA ALOPECUROIDEA.** "*Delile*," *A. Braun.**

PLATE 1909.

Braun, Rabenh. & *Stiz.* Char. Europ. Exsicc. Nos. 62, 63, 81.

Nordst. & *Wahlst.* Char. Scand. Exsicc. Nos. 20, 21, 21b, 22a, 22b.

Chara alopecuroidea (*Delile*, Herb.) and vars. *A. Braun*, Schweiz. Char. p. 13. *Kütz.* Sp. Alg. p. 518; and Tab. Phyc. Vol. VII. p. 18, t. 45, f. ii.

C. alopecuroides, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 281; *A. Braun*, Consp. Char. Europ. p. 3; and in Monatsbericht Akad. Wissensch. Berlin, 1867, pp. 798 and 896. *Babing.* in Journ. Bot. 1863, p. 193, t. 7; and Man. ed. 8, p. 470. *Lange*, Fl. Danica, t. 2745.

C. intricata, *Agardh*, Syst. Alg. p. 125, (partly,—as to the plant from the Baltic Sea, according to an authentic specimen from Agardh, in the Kew Herbarium!)

C. papulosa, *Wallr.* Flor. Crypt. Germ. ii. p. 107.

C. Pouzolsii, (*Gay*, Herb.) *A. Braun* in Flora 1835, Vol. I. p. 58.

C. Wallrothii, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 12. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 41.

Lychnothamnus Wallrothii, *Wahlst.* Monog. Sver. Norg. Char. p. 23.

Lychnothamnus alopecuroides, *H.* & *J. Groves* in Journ. Bot. 1880, p. 161, t. 209, f. 10.

Lamprothamnus alopecuroides, *A. Braun*, Fragm. Monog. Char. p. 100, t. vi. f. 185–188. *Sydow*, Europ. Char. p. 41.

[* The name *C. alopecuroidea* is so generally used for this plant, that there is perhaps little use in changing it now; but its oldest published name, and that which according to the laws of botanical nomenclature should be adopted for it under Chara, is *C. papulosa*, Wallr. published in 1833; the next oldest is *C. Pouzolsii* (Gay Herb.), published by Braun in 1835, and why he should have changed it in 1847 to *C. alopecuroidea*, does not appear, for according to the type specimens, Gay's MSS. name was given in 1822, and Delile's in 1827, so that even on the ground of manuscript priority (which cannot be admitted) there was no reason for the change.—N. E. B.]

Monœcious. Dark green or olive. Stem slender, translucent, without cortical cells or spine-cells, but with very long retrorse spine-like stipule-cells, in one whorl, lower portion often with small one-celled bulbils. Branchlets 6 to 9 in a whorl, 3- to 5-jointed, the 2 or 3 lower joints nearly equal, and as thick as the stem, the terminal one much smaller and spine-like. Bracts 6 to 8 in a whorl, at all the nodes of the branchlets except the last one, spreading, spine-like, mostly all larger than the nucules. Nucules solitary at the lower nodes of the branches in the axils of the bracts, oval-ovoid, 10- to 12-striate, with a minute persistent subentire crown. Globules solitary on the inner side of the fertile branches, between the bracts alongside of the nucule.

In brackish water, very rare. Abundant in the shallow water of the brine pans on the west mouth of New Town, Isle of Wight, first found by Mr. A. G. More in August, 1862, and again in 1863, in the pits or reservoirs on the east side of the creek close to the village of New Town, growing in salt water 18 inches to 2 feet deep, [also found there in July 1881 by Mr. Charles Bailey]. Journ. Bot. 1863, p. 193 ; 1871, p. 207 ; [and 1881, p. 356].

England. Perennial. Summer.

A small plant, 3 to 6 inches long, the stems scarcely so thick as a darning-needle, with branchlets $\frac{1}{4}$ to $\frac{3}{4}$ inch long, the lowest ones generally unicellular, and without stipule-cells, which are present at the base of all the fertile whorls, and are sometimes nearly as long as the first joint of the branchlet. This first joint is generally about as long as the succeeding one, but sometimes only half as long.

The spine-like bracts and stipule-cells give this plant a very bristly appearance, which, together with the uncorticated cells readily distinguish it from all the British Charæ. Messrs. Groves say that the Isle of Wight specimens appear to be nearer the var. *Montagnei* of Braun, which I have not seen, but they appear to me not to differ from the Baltic variety *Wallrothii* in Nordstedt et Wahlstedt, 'Characeæ Scandinaviæ Exsiccatæ,' No. 21 B. The number 21 of the same set, and No. 81 of Braun, Rabenhorst and Stizenberger's published set, has more slender branches and longer stipule-cells and bracts than in any of the Isle of Wight specimens I have seen. [Between Delile's *type* of *C. alopecuroidea*, and the so-called varieties *Montagnei* (Montagne's specimens!), and *Wallrothii*, as named by Braun in the Kew Herbarium, and the Isle of Wight plant, I fail to find any distinction, beyond degree of incrustation ; and Gay's *type* of *C. Pouzolsii* only differs in its longer and more slender bract-cells and stipulodes.—N. E. B.]

Foxtail Chara.

SECTION II.—TOLYPELLOPSIS. *Leonhardi.* (CHARÆ ASTEPHANÆ. *A. Braun.*)

Internodes of the stem pellucid, naked, without a covering of parallel cortical cells, and with the stipule-cells at the base of each whorl of branchlets rudimentary or absent. [Diœcious. Globules at the nodes of the branchlets, between the bracts, solitary or in pairs.] Nucules [at the nodes of the branchlets, solitary (always ?),] with a persistent crown of 5 very minute cells.

SPECIES II.—CHARA STELLIGERA. *Bauer.**

PLATE 1910.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 1, 34.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 49a, 49b.

Chara obtusa, *Desv.* in *Loisel. Deslongch.* Notice sur les plantes à ajouter à la Flore de France, p. 136. *H. & J. Groves* in Journ. Bot. 1881, p. 1, t. 216.

C. stelligera, "*Bauer* in *Moessler's* Handb. der Gewäch. ed. 2, p. 1595." *Bischoff*, Handb. Bot. Term. und Syst. t. 57, f. 2805. *A. Braun* in Ann. des Sciences Nat. 2nd ser. Vol. I. p. 352; in Flora, 1835, Vol. I. p. 55; Consp. Char. Europ. p. 4; and in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 402. *Ganterer*, Österr. Char. p. 11, t. i. f. iv. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 127. *Leonhardi* in Brunn Verhandl. Vol. II. p. 177. *Wahlst.* Monog. Sver. Norg. Char. p. 24. *Babing.* Man. ed. 8, p. 470.

C. vulgaris, var. elongata, *Wallr.* Annus Bot. p. 182.

C. ulvoides, *Bertol.* in Bruni Nuov. Collez. d'Opusc. Scient. 1826, p. 113; and Fl. Ital. Vol. X. p. 21. *Amici*, Descriz. Char. p. 21, t. iv. f. viii. and ix. *Ganterer*, Österr. Char. p. 11, t. i. f. v.

C. translucens, and var. stelligera, *Reichenb.*, Iconog. Vol. IX. p. 2, t. 804, 805.

Nitella stelligera, *Kütz.* Phyc. Gen. p. 318; Phyc. Germ. p. 255; Sp. Alg. p. 518; and Tab. Phyc. Vol. VII. p. 11, t. 27, f. i. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 681; and Atlas, pl. 41, f. G; ed. ii. p. 892; and Atlas, pl. 47, f. H. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 267.

N. ulvoides, *Kütz.* Phyc. Gen. p. 318. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 267.

N. Bertolonii, *Kütz.* Tab. Phyc. Vol. VII. p. 11, t. 26, f. ii.

Lychnothamnus stelliger, *A. Braun*, Fragm. Monog. Char. p. 102, t. vi. f. 189. *Sydow*, Europ. Char. p. 45.

Diœcious. Olive green. Stem rather stout, translucent or opaque from being encrusted with carbonate of lime, without cortical cells or spine-cells, and with rudimentary stipule-cells in one whorl, scarcely projecting above the surface; lower portion of the stem almost always with the whorls of branchlets rudimentary, and full of starch-grains, [bulbils] resembling white, stellately 5- to 7-lobed rings, surrounding the stem. Branchlets 4 to 8 in a whorl, 1- to 3-celled, subobtuse, apiculate, simple or with 1 or 2 1-celled bracts at the nodes, resembling the terminal portion of the branchlet. "Nucules subglobose, 9-striate; coronula minute, conical, persistent; globules solitary or 2 together." (Groves, Journ. Bot. 1881, p. 2.) [When the globules are in pairs, only one bract is developed, the second globule taking the place of one of the bracts.]

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* [Mr. Boswell has followed Braun in adopting Bauer's name *C. stelligera* for this plant; but Desvaux's name *C. obtusa* has the claim of priority, and concerning the identity of the two there is no doubt, as specimens from both authors are preserved in the Kew Herbarium.—N. E. B.]

In deep water, very rare. In Filby Broad, 8 miles from Great Yarmouth, growing in water 4 feet deep; Hickling Broad, Somerton Broad, Stalham Broad, and Hundred Stream, Potter Heigham, Norfolk. South Devon. First found by Mr. Arthur Bennett, in September, 1880.

England. Perennial. Summer, Autumn.

A large plant, somewhat resembling Nitella translucens. Stem as thick as a stocking-wire, and the branchlets 2 to 6 inches long, [sometimes, and especially in the form called C. ulvoides, much stouter than represented on Plate 1910]. Remarkable on account of the white granular starlike bulbils on the lower part of the stem,* from which mainly the plant is propagated, as it very seldom fruits, though Mr. Bennett has found both the male and female plants in Filby Broad.

I have not seen British specimens, nor any foreign specimens, with either nucules or globules.

Star-bearing Chara.

SECTION III.—EU-CHARA.

Internodes of the stem more or less opaque, [rarely pellucid,] with [or rarely without] a covering of parallel cortical cells, and with 2 whorls (rarely only 1 whorl) of stipule-cells at the base of each whorl of branchlets. Globule placed below the nucule taking the place of one of the bracts, [or borne on a separate plant from that which bears nucules]. Nucule with a persistent crown of 5 conspicuous cells, which are erect or spreading.

[**A.** *Stem and branchlets without cortical cells, stipule-cells in one whorl.*

[* For an account of these and the bulbils on other species of Chara, see A. Clavaud in 'Bulletin de la Société Botanique de France,' Vol. X. pp. 137–148, pl. iii.]

SPECIES III.—CHARA BRAUNII. *Gmelin.*

PLATE 1911.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 10, 64.

Nordst. & Wahlst. Char. Scand. Exsicc. No. 87.

Chara Braunii, *Gmelin*, Fl. Badensis Alsatica, Vol. IV. (Suppl.) p. 646. *Bischoff*, Krypt. Gewächse, p. 26, t. i. f. 5. *Reichenb.* Iconog. Bot. Vol. IX. p. 1, t. 802. *Wallm.* in Kongl. Vet. Akad. Handl. Stock. 1854, p. 286. *Nordst.* in *Anderss.* Bot. Notiser 1863, p. 41. *Wahlst.* Monog. Sver. Norg. Char. p. 24.

C. coronata, (*Ziz. Herb.*) *Bischoff*, Krypt. Gewächse, p. 26, t. i. f. 7; and Handb. Bot. Term. und Syst. t. 57, f. 2817. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 353; in Flora, 1835, Vol. I. p. 59; Consp. Char. Europ. p. 4; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 897; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 403; and Fragm. Monog. Char. p. 108. *Ganterer*, Österr. Char. p. 13, t. i. f. vi. *Kütz.* Sp. Alg. p. 520; and Tab. Phyc. Vol. VII. p. 17, t. 43, f. i. *Durieu*, Explor. de l'Algérie, Bot. Atlas, pl. 39, f. 3. *Leonhardi* in Brunn Verhandl. Vol. II. p. 179. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 59. *Allen*, Char. Amer. p. 7, pl. iii.; and in Amer. Naturalist, Vol. XVI. p. 358, with plate and several woodcuts. *Sydow*, Europ. Char. p. 48. *Coss. & Germ.* Atlas Fl. Envir. Par. ed. ii. pl. 44.

C. flexilis, *Amici* Descriz. Chara, p. 5, t. i., f. i., and t. iii., f. i., not of Linn.

C. Cortiana, *Bertoloni* in *Amici* Descriz. Chara, p. 8; and Fl. Ital. Vol. X. p. 16.

C. cremosperma, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 12.

C. Stalii, *Visiani*, Fl. Dalm. Vol. III. p. 334. *Meneghini* in Atti della ottava Reunione degli Scienziati Italiani, Genova, 1847, p. 553.

Charopsis Braunii, *Kütz.* Phyc. Gener. p. 319; and Phyc. Germ. p. 257.

Nitella Braunii, *Rabenh.* Deutsch. Krypt. Fl. ed. i. Vol. II. p. 197.

Monœcious. Bright green or olive. Stem slender or moderately stout, flexible, translucent or rarely opaque from being encrusted with carbonate of lime, without cortical cells or spine-cells; stipule-cells in one whorl, of the same number as there are branchlets in a whorl, and alternating with them, very short, spreading, acute. Branchlets 7 to 11 in a whorl, ascending, or slightly incurved, without cortical cells, 3- to 5-jointed; their joints of nearly equal length, the terminal joint tipped with from 2 to 5 minute acute cells. Bracts 3 to 10 in a whorl, those on the inner side of the branchlet usually shorter than the nucules, but sometimes as long or longer; those on the outside of the branchlet shorter than the inner ones, rudimentary, or altogether deficient, especially at the sterile nodes of the branchlet. Nucules in the axils of the bracts at the 2 or 3 lowest nodes of the branchlets, solitary, or in pairs, or at the lowest node sometimes 3 together, ovoid, 9- to 11-striate, with a short erect, somewhat spreading, or connivent crown, when ripe of a brownish-yellow colour with a blackish nucleus. Globules solitary or in pairs placed immediately beneath the nucules.

In a canal near Reddish, South Lancashire; discovered by Mr. Charles Bailey in September, 1883.

England. Annual? Summer, Autumn.

Stems branched, slender or moderately stout, very variable in size, being from 2 to 18 inches in length, with branchlets from $\frac{1}{3}$ of an inch to an inch or more long, the internodes of the stem being shorter or longer than the branchlets; the length of the bracts and size of the nucules also vary considerably. The Lancashire plant is rather more slender than usual, and the nodes of the branchlets are not constricted as in the Continental forms.

C. Braunii is one of the most distinct species of British Charas, being readily known by its uncorticated stems and branchlets, and the minute cells at the tips of the branchlets, which consist of the very reduced apical cell and the bracts of the ultimate node, and are very similar to those that terminate the branchlets of Nitella translucens. The claim of this species to be considered a native plant is perhaps somewhat doubtful, since Messrs. Groves state (Journ. Bot. 1884, p. 4) that the water of the canal in which it grows "is raised to an abnormal temperature by the hot water from the adjacent mills. *Naias alagnensis*,* a native of Egypt, has been found in the same neighbourhood, and as its introduction is ascribed to the use of Egyptian cotton in the mills, there seems a possibility of C. Braunii, also an inhabitant of Egypt, having been introduced by the same means, although the distribution of the latter is such as to make its occurrence in this country probable."

This species is found nearly all over the world, therefore it is not unlikely to prove a native of the British Isles, and should be looked for in ponds, streams, lakes, &c.—N. E. B.

B. *Stem with as many rows of cortical cells as there are branchlets to a whorl, stipule-cells in two whorls, all well developed, setaceous.*]

SPECIES IV.—CHARA CRINITA. *Wallr.*

PLATE 1912.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 6, 65, 66, 67, 68, 80, 118.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 23, 24, 25, 26, 27, 28, 29, 29b.

Chara crinita, *Wallr.* Annus Bot. p. 190, t. iii. *Bruzel.* Obs. Char. pp. 10 and 19. *Agardh*, Syst. Alg. p. 126. *Bischoff*, Handb. Bot. Term. und Syst. t. 57, f. 2821. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 356; in Flora, 1835, Vol. I. p. 70; Consp. Char. Europ. p. 5; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 404; in

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[* A very full account with good figures of this plant, will be found in the Journal of Botany 1884, p. 305, where it is described as *Naias graminea*, Delile, var. *Delilei*, Magnus.]

Monatsber. Akad. Wissensch. 1867, p. 901; and Fragm. Monog. Char. p. 137, t. vii. f. 221–2. *Kütz.* Phyc. Gener. p. 320; Phyc. Germ. p. 259; Sp. Alg. p. 525; and Tab. Phyc. Vol. VII. p. 27, t. 69, f. i. *Rupr.* in Beitr. zur Pflanz. Russ. Reich. 1845, dritte liefer. p. 18. *Ganterer*, Österr. Char. p. 14, t. ii. f. viii. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 88; and Man. ed. 8, p. 471. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 319. *Wahlst.* Bidr. Skand. Char. p. 31; and Monog. Sver. Norg. Char. p. 25. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 41. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 126. *Leonhardi* in Brunn Verhandl. Vol. II. p. 180. *Lange*, Fl. Danica, t. 2747. *Sydow*, Europ. Char. p. 52. *Allen*, Char. Amer. p. 5, pl. ii.; and Bull. Torrey Bot. Club, Vol. IX. p. 40, pl. xviii.

C. hispida, var. crinita, *Wahlenb.* Fl. Suec. p. 717.

C. Karelini, *Lessing* in Linnæa, Vol. IX. p. 213. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 322. *Kütz.* Tab. Phyc. Vol. VII. p. 28, t. 71, f. ii.

C. condensata, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 320; not of Rupr.

C. pusilla (*Dethard*), Kütz. in Flora, 1834, Vol. II. p. 706; Phyc. Gener. p. 320. *Kütz.* Phyc. Germ. p. 260; (*Floerke*) *Kütz.* Sp. Alg. p. 526; and Tab. Phyc. Vol. VII. p. 28, t. 69, f. ii.

C. canescens, *H. & J. Groves*, in Journ. Bot. 1880, p. 134, t. 208, f. 9; scarcely of *Loisel. Deslong.**

C. evoluta, *Allen* in Bull. Torrey Bot. Club, Vol. IX. p. 41, pl. xix.

C. altaica, *A. Br.* Fragm. Monog. Char. p. 148, t. vii., f. 228–231.

Diœcious [or rarely monœcious]. Dark green. Stem slender, translucent, or opaque from being encrusted with carbonate of lime, rather faintly spirally striate from being coated with as many cortical cells as there are branchlets in the whorl, and with numerous (usually very numerous) spreading or spreading-retrorse fasciculated long setaceous spines; stipule-cells in two whorls, all are setaceous and spine-like. Branchlets 8 to 10 in a whorl (mostly 5, Braun), short, slender, often incurved, 4- to 8-jointed (mostly 5-jointed, Braun), clothed with cortical cells, except 1 or 2 joints at the apex. Bracts 7 to 11 in a whorl, at all the nodes of the branches, except sometimes the last 1 or 2, spreading-ascending, spine-like, mostly all longer than the nucules, usually twice as long [or the innermost bracts very much shorter than the nucules]. Nucules in the axils of the bracts at 2 or 3 or rarely 4 of the lowest nodes of the branch, oblong-oval, 10- to 13-striate, with a conspicuous erect persistent crown. Globules on separate plants from those bearing nucules, very rarely produced.

In pools of brackish water, very rare. Budock Pool, near Falmouth, Cornwall, Rev. W. L. P. Garnons.† Here it grows in

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[* According to specimen named by Desveaux, in the Kew Herbarium, which is probably authentic, *C. canescens* Loisel. Deslong. is *C. aspera*, Willd.]

[† By Professor Babington this locality is incorrectly spelt Burdock Pool in Ann. Nat. Hist. and in Man. Brit. Bot. ed. 8.]

company with Ch. aspera. Little Sea, Studland, Dorset, Mr. Bolton King. West Cornwall. Ireland, D. Moore, no exact locality given. The male plant only is in Professor Babington's Herbarium.

England, Ireland. Annual. Summer, Autumn.

Very variable in size, being from 1 inch to 18 inches or more, and with the branchlets $\frac{1}{8}$ to 1 inch long. The smaller forms seem to be more densely spinous than the larger, judging from the specimens in the Char. Europ. Exsicc. and the Char. Scandinav. Exsicc. I have not seen any British specimen.

The shape of the nucules is apparently variable. I have described them from the published sets above mentioned. Wallroth figures them linear-fusiform, and describes them as 'oblongo-linear.' Babington gives 'narrowly-oblong,' and Groves 'oval,' as their form.

The globules are very rarely seen. Wallroth says he never saw them, and A. Braun says that in Germany and Scandinavia the female plant only is found, and the fructification is parthenogenetic.

[The male plant of this species is excessively rare in Europe, but the hermaphrodite plant is not unlikely to be found, as in N. America a monœcious state of it has been discovered and described as a distinct species (*C. evoluta*) by Dr. Allen, but it is certainly nothing more than the hermaphrodite plant of C. crinita, and further supports the opinion expressed under N. syncarpa var. opaca, that the character monœcious or diœcious, unless accompanied with such distinctions as cannot be regarded as correlated with sex, is not a specific character, especially in such a group as this, where the species vary exceedingly, and the characters within certain limits are most unstable, and even when constant in certain localities, are possibly only conditional upon the depth, temperature, exposure, and chemical constituents of the water they grow in. *C. altaica*, Braun, is also the hermaphrodite plant of C. crinita. Not having seen fresh British specimens, my drawing was made partly from the Irish specimen, and partly from Continental ones.—N. E. B.

Bearded Chara.

C. *Stem with twice as many rows of cortical cells as there are branchlets in a whorl; stipule cells in two whorls, papillate, ovoid, or setaceous.*]

SPECIES V.—CHARA TOMENTOSA. *Linn.*

PLATE 1913.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 8, 9, 35, 36.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 30, 31, 50, 50b, 51, 52, 53, 54, 88, 89.

Chara tomentosa, *Linn.* Sp. Pl. ed. i. p. 1156. *Hornemann*, Fl. Danica, t. 1941. *Bruzel*, Obs. Char. pp. 13 and 20. *Agardh*, Syst. Alg. p. 127. *Rupr.* in Beitr. zur Pflanz.

Russ. Reich. 1845, dritte liefer. p. 15. *Kütz.* Phyc. Gen. p. 321; Phyc. Germ. p. 260; Sp. Alg. p. 526; and Tab. Phyc. Vol. VII. p. 29, t. 74, f. i. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 90; and Man. ed. 8, p. 472. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 317. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 51. *Wahlst.* Monog. Sver. Norg. Char. p. 30. *H.* & *J. Groves* in Journ. Bot. 1880, p. 130, t. 207, f. 5.

C. latifolia, *Willd.* in Gesellschaft Nat. Freunde zu Berlin Mag. Vol. III. p. 299. *Hook.* Lond. Journ. Bot. 1842, Vol. I. p. 43; and Icon. Pl. Vol. VI. t. 532.

C. ceratophylla, *Wallr.* Annus Bot. p. 192, t. v. *Bruz.* Obs. Char. p. 20. *Agardh,* Syst. Alg. p. 127. *Hornemann,* Fl. Danica, t. 1654. *Bischoff,* Krypt. Gewächse, t. i. f. 16; and Handbk. Bot. Term. und Syst. t. 57, f. 2816. *Kutz.* Phyc. Gener. p. 321; Phyc. Germ. p. 260; Sp. Alg. p. 526; and Tab. Phyc. Vol. VII. p. 29, t. 73. *Ganterer,* Österr. Char. p. 16, t. ii. f. x. xi. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 318. *Wahlst.* Bidr. Skand. Char. p. 34. *Leonhardi* in Brunn Verhandl. Vol. II. p. 197. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 355; Consp. Char. Europ. p. 5; in Flora, 1835, Vol. I. p. 65; Schweiz. Char. p. 18; in *Cohn,* Krypt. Fl. Schles. Vol. I. p. 404; and Fragm. Monog. Char. p. 139. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 60. *Sydow,* Europ. Char. p. 66.

Diœcious. Dark green, or greenish-grey, or even greenish-white from being encrusted with carbonate of lime. Stem stout and somewhat translucent when not encrusted, but opaque from having a thick covering of carbonate of lime when growing in fresh water, conspicuously spirally striate from being clothed with twice as many cortical cells as there are branchlets in the whorl, and with scattered ovate-conical or ovoid apiculate spine-cells, situated on the primary cortical cells (i.e. those which correspond to the branchlets). Stipule-cells in 2 whorls (sometimes 3, Braun), ovate-ovoid, acuminated, resembling the spine-cells, but smaller. Branchlets 5 to 7 in a whorl ("mostly 6," Braun), moderately long, stout, often incurved, 4- to 6-jointed, clothed with cortical cells, except 1 to 3 joints at the apex which are naked and larger, pellucid, oblong or cylindrical, sometimes tipped by a small cell resembling the spine-cells. Bracts mostly 5 in a whorl, unequal, oval-ovoid or oblong-ovoid or cylindrical, mostly acute and apiculate; the lateral ones longer than the nucules, 3 before it shorter or rudimentary. Nucules in the axils of the bracts of 1 or 2, rarely 3, of the lowest nodes of the branchlet, oval-ovoid, 12- to 14-striate, with a conspicuous spreading-erect persistent crown. Globules on a separate plant from that bearing nucules, much more common than nucules.

In fresh and salt water, very rare. Belvedere Lake, West Meath, found by Dr. D. Moore in 1841; and afterwards found by him in another locality in the river Shannon below Portumna. Hundred Stream, near Potter Heigham, Norfolk, A. Bennett.

England, Ireland. Perennial. Autumn.

A very variable plant. The Irish specimens I have seen belong to a very small form, with slightly branched, brittle, greatly encrusted stems and branchlets, the latter with 1 or 2 of the lower joints furnished with cortical cells, but sometimes (especially in the lower part of the stem) the branchlets consist of but a single long cell without cortical layers. The primary cortical cells are much more prominent than the secondary cortical cells. The spine-cells and stipule-cells are much smaller in size than in the ordinary continental forms, but Messrs. Groves give a figure of one of the Portumna specimens in Dr. Moore's herbarium, which is furnished with large stipule-cells.

Nucules appear to be very rare in this plant. I have described them from Nordstedt and Wahlstedt's 'Characeæ Scandinaviæ Exsiccatæ,' No. 88. The globules are frequently to be met with, and are much larger than the nucules.

Tomentose Chara.

SPECIES VI.—**CHARA FŒTIDA.** *A. Braun.*

PLATES 1914 AND 1915.

Monœcious. Dark green or more often greenish-grey or even greenish-white, from being encrusted with carbonate of lime. Stem slender or rather slender, brittle, translucent when not encrusted, but much more usually opaque from having a thick covering of carbonate of lime, strongly spirally striate, clothed with twice as many cortical cells as there are branchlets in a whorl, slightly rough, without spine-cells or with few or (more rarely) numerous scattered papilliform or oblong-cylindrical, generally appressed, obtuse spine-cells, situated on the primary cortical cells in the upper part of the internodes; stipule-cells in 2 whorls, inconspicuous, resembling papillæ. Branchlets 6 to 10 in a whorl, mostly 8, long or short, slender, often incurved but sometimes recurved, 5- to 7-jointed; clothed with cortical cells, except from 2 to 4, mostly 3 joints at the apex, which are naked. Bracts 4, rarely 6, developed on the inner side of the branch, those on the outer side rudimentary or absent, oblong-cylindrical or setaceous, obtuse, the two interior ones longer than the others, and generally twice or more the length of the nucule, rarely only equalling it. Nucules in the axils of the bracts at 2 to 5 of the lowest nodes of the branchlet, oval-ovoid, 12- to 14-striate, with a conspicuous erect persistent crown. Globule solitary with the nucule, and placed immediately below it.

[Var. α. *genuina*.

PLATE 1914.

Braun, Rabenh. & *Stiz.* Char. Europ. Exsicc. Nos. 7, 39, 40, 41, 69, 82, 83, 91, 110.

Nordst. & *Wahlst.* Char. Scand. Exsicc. Nos. 90, 91, 92, 93, 94, 95, 96, 97.

C. fœtida, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 354; in Flora, 1835, Vol. I. p. 63; Schweiz. Char. p. 14; Consp. Char. Europ. p. 5; in Monatsber. Akad. Wissensch. 1867, p. 910; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 406; and Fragm. Monog. Char. p. 159. *Bischoff*, Handb. Bot. Term. und Syst. t. 57, f. 2807 and 2815. *Coss.* & *Germ.* Fl. Envir. Par. ed. i. p. 679; and Atlas, p. 37; ed. ii. p. 889, and Atlas, pl. 41, f. 1–7. *Ganterer*, Österr. Char. p. 18, t. ii. f. xii. xiii. *Wallm.* in Kongl. Vet. Akad. Handl. Stock. 1854, p. 304. *Wahlst.* Bidr. Skand. Char. p. 11; and Monog. Sver. Norg. Char. p. 26. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 45. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 125. *Leonhardi* in Brunn Verhandl. Vol. II. p. 190. *Babing.* Man. ed. viii. p. 471. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 70 (32 forms described). *Sydow*, Europ. Char. p. 72.

C. vulgaris, *Linn.* Sp. Pl. ed. i. p. 1156, in part. *Sm.* Engl. Bot. No. 336. *Wallroth*, Annus Bot. p. 179, t. i. *Bruzel*, Obs. Char. pp. 5 and 21. *Agardh*, Syst. Alg. p. 128. *Kütz.* Phyc. Gener. p. 319; Phyc. Germ. p. 258; Sp. Alg. p. 523; and Tab Phyc. Vol. VII. p. 24, t. 58, f. i. *Rupr.* in Beitr. zur Pflanz. Russ. Reich. 1845, dritte liefer. p. 12. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 89. *H.* & *J. Groves* in Journ. Bot. 1880, p. 133, t. 208, f. 8.

C. montana, *Pers.* Synop. Vol. II. p. 530.

C. atrovirens, *Lowe* in Trans. Cambr. Philos. Soc. Vol. VI. p. 551.

C. funicularis, *Thuill.* Fl. Envir. Par. p. 473.

C. decipiens, *Desv.* in *Loisel. Deslong.* Notice sur le Pl. à ajouter à la Fl. de France, p. 138.

C. papillata, *Wallr.* Annus Bot. p. 183.

C. collabens, *Agardh*, Syst. Alg. Introd. p. xxviii. *Kütz.* Sp. Alg. p. 524.

C. stricta, C. refracta, *Kütz.* in Flora, 1834, Vol. II. p. 707; Phyc. Gener. p. 320; and also C. polysperma, Phyc. Germ. p. 258; Sp. Alg. p. 523–4; and Tab. Phyc. Vol. VII. p. 24, t. 59, f. i. and t. 58, f. ii. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, pp. 306, 307, 328.

C. seminuda and C. longibracteata, *Kütz.* Tab. Phyc. Vol. VII. pp. 24, 25, t. 59, f. ii. and t. 60, f. i.

C. crassicaulis (*Schreber*), *Kütz.* Tab. Phyc. Vol. VII. p. 25, t. 60, f. ii. *A. Braun*, Consp. Char. Europ. p. 5; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 921;* and Fragm. Monog. Char. p. 168.

[* The description at this place does not agree with *crassicaulis*, but appears rather to belong to the form *subhispida*.]

C. coarctata, C. sphagnoides, C. longibracteata, and C. crispa. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, pp. 301, 302, 305, and 311.

C. subhispida, *A. Braun* in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 407; and Fragm. Monog. Char. p. 167.

Spine-bearing primary cortical cells, less prominent than the spineless secondary cells.

Var. β. *contraria*. Coss. & Germ.

PLATE 1915.

Braun, Rabenh. & *Stiz.* Char. Europ. Exsicc. Nos. 37, 38, 84, 88, 89, 90, 120.

Nordst. & *Wahlst.* Char. Scand. Exsicc. Nos. 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 77b.

Chara fœtida, var. contraria, *Coss.* & *Germ.* Fl. Envir. Par. ed. ii. p. 890; and Atlas, pl. 41, f. 8.

C. contraria, *A. Braun* ex *Kütz.* Phyc. Germ. p. 258; Sp. Alg. p. 523; and Tab. Phyc. Vol. VII. p. 25, t. 61. *A. Braun*, Schweiz. Char. p. 15; Consp. Char. Europ. p. 6; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 905; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 405; and Fragm. Monog. Char. p. 141. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 304. *Wahlst.* Bidr. Skand. Char. p. 15; and Monog. Sver. Norg. Char. p. 31. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 126. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 46. *Leonhardi* in Brunn Verhandl. Vol. II. p. 201. *H.* & *J. Groves* in Journ. Bot. 1881, p. 354, t. 224, f. 2. *Babing.* Man. ed. 8, p. 471. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 64 (14 forms described). *Sydow*, Europ. Char. p. 57.

C. fœtida, var. moniliformis, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 355.

C. fœtida, var. hispidula, *Coss.* & *Germ.* Fl. Envir. Par. ed. i. p. 680; and Atlas, p. 37, f. 5.

Spine-bearing primary cortical cells more prominent than the spineless secondary cortical cells.]

In pools, ditches, streams, etc. [Var. α.—] Very common, and generally distributed, extending to Orkney. [Var. β.—Is recorded from several counties, and if searched for, will probably be found in most.]

England, Scotland, Ireland. Annual or perennial. Summer, Autumn.

A very variable plant, varying in length from 3 or 4 inches to nearly 2 feet, with stems usually about the thickness of a darning-needle, but sometimes considerably thicker. The distance of the whorls, the length and direction of the branches, the length of the bracts, the number and shape of the spine-cells, are all liable to great variation. One of the most distinct forms is the var. *crassicaulis* of Schleicher, which is regarded as a distinct species by Braun. This resembles C. tomentosa in miniature, having the stem and the branchlets thicker than in the type. Messrs. Groves state that there are in the British Museum and Kew Herbaria [Borrer Herbarium] specimens of this form from Coventry Park, Warwick, collected by Mr. T. Kirk in 1856. [The Kew Herbarium also contains a specimen labelled 'Ireland, D. Moore.' The plant collected by Mr. G. Nicholson at Thornton-le-Street, near Thirsk, Yorkshire, is stated by Messrs. Groves in Journ. Bot. 1881, p. 356 to be var. *crassicaulis*, it is, however, not that plant, but the form *subhispida*, (which Braun first described as a variety, afterwards as a species,) having very prominent secondary cortical cells and numerous spine-cells. The var. *crassicaulis* has all the cortical cells nearly equally prominent, no spine-cells, or only very minute ones, and short incurved stoutish branchlets, with their terminal uncorticated joints much stouter than usual, and in the dried state apparently inflated.] The figure they give of this plant in the 'Journal of Botany,' however, appears to have much more tapering branches than the specimens given in No. 69 of Braun, Rabenh. and Stiz. Char. Eur., and No. 97 of Wahlstedt and Nordstedt, Char. Scand. [This number (97) in the Kew set is not var. crassicaulis at all, but the form *subhispida*, = C. collabens, Ag. !]

[A form in which the nucleus of the ripe nucules is black instead of brown (var. *melanopyrena*, A. Braun), is stated by Messrs. Groves to have been collected near Bridgerule, Cornwall, by Mr. W. Rogers in 1883.

Var. *contraria* is usually smaller, more rigid, and has shorter and more incurved branchlets than most of the forms of var. *α*, but exhibits much the same general range of variation, and some forms are only to be distinguished from the type, by the greater prominence of the primary cortical cells, i.e., those which correspond to the middle of the base of the branchlets, and upon which the spine-cells are placed, which is the chief and only reliable character; as in all the forms of var. *α* they are less prominent than the secondary ones. *C. jubata*, Braun (*C. contraria* var. *jubata*, Müller), which appears to be only a deep-water state of the var. contraria, and only differs from it by its longer stems with very distant whorls of exceedingly short branchlets, which are sometimes reduced to mere papillæ $\frac{1}{6}$ to $\frac{1}{8}$ of a line long, sometimes 1 to 3 lines long, may perhaps be found in some of our lakes.]

Generally speaking, C. fœtida is more or less whitish from being encrusted with carbonate of lime, but dark bright green forms, [*C. atrovirens*,] without encrustation occasionally occur. [The variety or state, *gymnophylla*, A. Braun, in which the branchlets are uncorticated, is not unlikely to occur, and should be searched for.] Messrs. Groves, in their excellent paper on British Characeæ in the 'Journal of Botany,' have reverted to the name *vulgaris* for this species, but although the name *fœtida* has been used with different degrees of latitude by Braun himself, it is generally accepted subject to different opinions as to species and varieties. At any rate, the name *vulgaris* is untenable as dating back to Linnæus, who under it included forms now universally considered distinct. C. fœtida possesses in a special degree an unpleasant odour.

Fetid Chara.

SPECIES VII.—**CHARA HISPIDA.** [*Oeder* and other authors, not of Linn.*]

PLATES 1916–1918.

Monœcious. Dark green or more often greenish-grey or greenish-white, from being encrusted with carbonate of lime. Stem stout or rather stout, brittle, opaque from having a thick covering of carbonate of lime, spirally sulcate, clothed with twice as many cortical cells as there are branchlets in a whorl, rough with few or numerous, sometimes very numerous, more or less fasciculated, retrorse or retrorsely-spreading, setaceous, acute, deciduous spine-cells, situated on the primary cortical cells in the upper part of the stem and branches; stipule-cells in 2 whorls, very conspicuous, resembling short setaceous spines. Branchlets 7 to 11 in a whorl, mostly 10, rather long, rather slender, ascending-spreading or slightly incurved, 6- to 9-jointed, clothed with cortical cells, except one or two minute joints, [in some varieties 3 to 6 joints] at the apex, which are naked. Bracts 6 to 10 in a whorl, setaceous, acute, unequal, from 2 to 5 of the interior ones being much longer than the others, and generally twice or more the length of the nucule—rarely only equalling it, the outer ones shorter or more rarely rudimentary. Nucules in the axils of the bracts, at 2 to 5, mostly 4 of the lowest nodes of the branchlet, broadly oval-ovoid, 12- to 15-striate, with a conspicuous erect-spreading persistent crown. Globules solitary with the nucule and placed immediately below it.

Var. *α. genuina.*

PLATE 1916.

Braun, *Rabenh.* & *Stiz.* Char. Europ. Exsicc. Nos. 2, 3, 4, 49, 70, 71, 85, 86, 87, 117.

Nordst. & *Wahlst.* Char. Scand. Exsicc. Nos. 55a and b, 56, 57a and b, 58, 59, 59b, 60a, b, c, and d, 61; (*rudis*, 62, 63, 64a and b, 65, 66); (*horrida*, 98, 99a and b, 100, 101.)

Chara hispida, *Oeder*, Fl. Danica, t. 154. *Sm.* Eng. Bot. No. 463. *Wallr.* Annus Bot. p. 187, t. iv. *Bruz.* Obs. Char. pp. 9 and 20. *Agardh*, Syst. Alg. p. 128. *Bischoff*, Krypt. Gewächse, p. 26, t. i. f. 9–11; and Handb. Bot. Term. und Syst. t. 56, f. 2799–2801, and t. 57, f. 2813. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I.

[* According to Linnæus' type specimen, the plant he described as *C. hispida* is that now well known as *C. aspera !* But the name *C. hispida* is so universally adopted for the plant here described as such, that there is little use now in substituting the name *C. spinosa*, Rupr. for it, which should be done if the Linnean name *C. hispida* were retained for *C. aspera.*]

p. 355; Schweiz. Char. p. 17; Consp. Char. Europ. p. 5; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 407; and Fragm. Monog. Char. p. 171. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 679; and Atlas, pl. 38 f. B, 1–2; ed. ii. p. 888; and Atlas, pl. 42, f. B, 1–2. *Kütz.* Phyc. Gener. p. 320; Phyc. Germ. p. 259; Sp. Alg. p. 524; and Tab. Phyc. Vol. VII., pp. 26, 27, t. 65 to 67, f. i. *Ganterer*, Österr. Char. p. 17, t. ii. f. xiv. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 89; and Man. ed. 8, p. 471. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 308. *Wahlst.* Bidr. Skand. Char. p. 25; and Monog. Sver. Norg. Char. p. 28. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 125. *Leonhardi* in Brunn Verhandl. Vol. II. p. 186. *H. & J. Groves* in Journ. Bot. 1880, p. 131, t. 208, f. 7. *Müller* in Bull. Bot. Genève, 1881, p. 83. *Sydow*, Europ. Char. p. 80.

C. spinosa, *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 15. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 47.

C. equisetina, *Kütz.* in Flora, 1834, Vol. II. p. 706; Phyc. Gener. p. 320; Phyc. Germ. p. 259; Sp. Alg. p. 525; and Tab. Phyc. Vol. VII. p. 27, t. 68, f. i.; *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 319.

C. horrida, *Wallm.* (under C. baltica var. fastigiata) in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 314. *A. Braun*, Consp. Char. Europ. p. 6; and Fragm. Monog. Char. p. 172. *Wahlst.* Bidr. Skand. Char. p. 24; and Monog. Sver. Norg. Char. p. 30. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 49. *Sydow*, Europ. Char. p. 84.

C. acicularis, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 315?

C. rudis, *A. Braun*, Consp. Char. Europ. p. 6; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 408; and Fragm. Monog. Char. p. 173. *Leonhardi* in Brunn Verhandl. Vol. II. p. 185. *Wahlst.* Monog. Sver. Norg. Char. p. 29. *Sydow*, Europ. Char. p. 83.

C. subspinosa, *Rupr.* Symbolæ, p. 225.

Encrusted. Spine-bearing primary cortical cells less prominent than the spineless secondary cortical cells. Spine-cells few or numerous.

[Var. β. *baltica.* Hartmann.

PLATE 1917.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 44, 96, 114.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 35, a, b, c, and d, 36, 37, 38, 39, 40, 103, 104, 105a and b.

Chara hispida, var. baltica, "*Hartm.* Skand. Fl. ed. i. p. 377," *Wahlenberg*, Fl. Suec. ed. 1, p. 693.

C. baltica, "*Fries* in *Aspegren's* Blekings Fl. p. 65." *Agardh*, Syst. Alg. p. 127. *Bruzel*, Obs. Char. pp. 11 and 19. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 354; Consp. Char. Europ. p. 6; and Fragm. Monog. Char. p. 156. *Kütz.* Phyc. Germ. p. 259; Sp. Alg. p. 524; and Tab. Phyc. Vol. VII. p. 26, t. 63, f. ii. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 313. *Wahlst.* Bidr. Skand. Char. p. 16; and Monog. Sver. Norg. Char. p. 34. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 49. *Hornemann*, Fl. Danica, t. 2311. *Babing.* Man. ed. 8, p. 472. *Sydow*, Europ. Char. p. 64.

C. firma, *Agardh*, Syst. Alg. Introd. p. xxviii. *Kütz.* Tab. Phyc. Vol. VII. p. 26, t. 64, f. i. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 50.

C. Nolteana, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 354; and in Flora, 1835, Vol. I. p. 62. *Kütz.* Tab. Phyc. Vol. VII. p. 26, t. 64, f. ii. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 312. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 49.

C. Liljebladii, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 314. *Nordst.* in *Anderss.* Bot. Notiser, p. 50.

C. baltica, var. affinis, *H. & J. Groves,* in Journ. Bot. 1881, p. 354, t. 224, f. 1.

Not encrusted. Spine-bearing primary cortical cells as prominent as, or more prominent than the secondary cells. Spine-cells few or numerous.]

? Var. γ. *pseudocrinita.* A. Braun.

PLATE 1918.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 48, 72, 97, 119.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 78, 79, 80a and b.

Chara hispida, var. pseudocrinita, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 355; and in Flora, 1835, Vol. I. p. 67. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 679; and Atlas, p. 38, f. B 3; ed. ii. p. 889; and Atlas, pl. 42, f. B 3. *Wallm.* in Kongl. Vet. Akad. Handl. Stock. 1854, p. 311.

C. hispida, var. dasyacantha, *A. Braun*, Schweiz. Char. p. 18. *Kütz.* Sp. Alg. p. 525; and Tab. Phyc. Vol. VII. p. 27, t. 66, f. b.

C. polyacantha, *A. Braun* in *Br.* Rabenh. & Stiz. Exsicc. No. 48; Consp. Char. Europ. p. 6; and Fragm. Monog. Char. p. 150. *Wahlst.* Bidr. Skand. Char. p. 29; and Monog. Sver. Norg. Char. p. 34. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 48. *Leonhardi* in Brunn Verhandl. Vol. II. p. 199. *Lange*, Fl. Danica, t. 2746. *H. & J. Groves*, in Journ. Bot. 1880, p. 131, t. 208, f. 6. *Babing.* Man. ed. 8, p. 472. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 63. *Sydow*, Europ. Char. p. 61.

C. pedunculata, *Kütz.* in Flora, 1834, Vol. II. p. 706—altered to C. spondylophylla in *Kutz.* Phyc. Gener. p. 320; Phyc. Germ. p. 259. Sp. Alg. p. 525; and Tab. Phyc. Vol. VII. p. 27, t. 68, f. ii. (by error printed C. spondylophora). *Wallm.* in Kongl. Vet. Akad. Handl. Stock. 1854, p. 311.

C. intertexta, *Tenore*, Viagg. in Abruzzo, 1830, p. 90; and Syllog. Fl. Neapol. p. 484 (according to an authentic specimen at Kew, not of Desveaux).

Encrusted. Spine-bearing primary cortical cells more prominent than the spineless secondary cortical cells. Spine-cells very numerous.

In ponds, pools, and ditches, &c. Var. *α* not uncommon, and generally distributed in England; less frequent in Scotland, where it has been recorded from the counties of Berwick, Roxburgh, Haddington, Fife, Forfar, Sutherland, and Perth. In Ireland in counties Wicklow, Galway, Westmeath, and Derry.

[Var. *β*, rare. In a stream running into Kynance Cove, and in the neighbouring pools, Cornwall.]

Var. γ, rare. Recorded from Cambridgeshire, Yorkshire, Hickling Broad, Norfolk, Cumberland, Anglesea, Roxburgh, Fife, Cork, Galway, and Mayo.

England, Scotland, Ireland. Perennial. Summer, Autumn.

A very variable plant, generally much encrusted. Stems 1 to 3 feet long, often as thick as a crow-quill, and sometimes equalling a goose-quill. The number and length of the spines is very variable, and they appear to be more persistent in some forms than in others. The length of the stipule-cells and bracts is also liable to much variation.

One of the most striking varieties is the *C. horrida* of Wallman, which is an unencrusted form with short branchlets, and very numerous persistent spine-cells, and with bulbils on the buried portion of the stem [which also occur on typical and other forms of hispida]. Braun enters it as a species in the Consp. Char. Europ. p. 6, and Exsicc. Nos. 71 and 87, but remarks, "Ch. hispidæ proxima, cujus varietas marina esse videtur." Messrs. Groves give "Goldens Common, Freshwater, Isle of Wight, Herb. A. G. More."

[The variety *baltica* is a maritime form, distinguished by its greener unencrusted stems, with more prominent primary cortical cells: the spine-cells are very variable in number and size, being sometimes reduced to mere papillæ, sometimes short and more or less spreading, sometimes (as in all the Cornish specimens seen) long and more or less appressed to the stem, or ("spreading," H. & J. Groves). *C. Liljebladii* is merely a large state of this variety, with much longer and more spreading branchlets; and *C. Nolteana* is a state in which the branchlets are stout and uncorticated except the lowest joint.]

Var. *pseudocrinita* is perhaps a subspecies; it is more spinous than any of the forms of true hispida, except the form horrida, which it considerably resembles, except in the relative size of the primary and secondary cortical cells. I should be inclined to attach more importance to the character taken from the cortical cells, were it not that in C. contraria, Braun, we have a plant bearing the same relation to C. fœtida that C. polyacantha does to C. hispida.

When we find two plants, which let us call A and B, have forms allied to them which let us call *a* and *b*. If A is to *a* as B is to *b*, then the probability is that *a* and *b* are but varieties of A and B. It is the rule that species have varieties similarly related to them; but true species, and even subspecies, seldom follow any such relation.

C. hispida bears considerable resemblance to the forms of C. fœtida,* in which the stem is furnished with spine-cells; but it is a stouter plant, with the stem more furrowed when dry, and with

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[* In the Monatsbericht Akad. Wissenschaften Berlin, 1867, p. 922, Braun states *C. hispida* to be a subspecies of *C. fœtida.*]

more numerous and fasciculated spine-cells in the upper part; the stipule-cells are more developed, the branches have more of the joints clothed with cortical cells, the bracts are more numerous at each node, and the nucules are broader in proportion to their length.

The form or variety *horrida*, and the variety or subspecies *pseudocrinita*, especially the latter, bear considerable resemblance to the larger states of C. crinita; but their stems are stouter, and have more numerous cortical cells than in crinita; the branchlets are stouter, the bracts more unequal and less spine-like; the nucules are larger, more deeply striate and with a larger crown, and each accompanied by a globule.

[*C. rudis*, Braun, is a slight form in which the secondary cortical cells are more prominent than usual.

Another trifling variety of this variable species, which will probably be found to occur, is *C. papillosa*, Kütz. (*C. intermedia*, Braun). It is like typical C. hispida, but has the primary cortical cells more prominent than the secondary ones, and few spine-cells, which are sometimes minute and papilliform, sometimes spine-like. Braun quotes *C. aculeolata*, Kütz. as one of the synonyms of his C. intermedia; but to judge from Kützing's figure, and a specimen at Kew named by Braun, it belongs rather to the var. pseudocrinita. As so many other characters of Characeæ are found to be inconstant, it is probable that the relative prominence of the cortical cells is likewise so, and that some of the so-called varieties or species are but states of one plant; this requires deciding by careful experimental cultivation.]

Bristly Chara.

[**D.** *Stem clothed with three times as many rows of cortical cells as there are branchlets in a whorl; stipule-cells in two whorls, all setaceous, or the lower whorl or both whorls often rudimentary.*]

SPECIES VIII.—**CHARA ASPERA.** *Willd.*

PLATE 1919.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 11, 12, 50, 74a, b, c, 98, 99, 111, 116.

Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 106, 107, 108, a, b, c, 109a, b, 110, 111, 112a, b, 113, 114.

Chara aspera, *Willd.* in Gesellschaft Nat. Freunde zu Berlin Mag. Vol. III. p. 298. *Wallr.* Annus Bot. p. 185. t. vi. f. 3. *Agardh*, Syst. Alg. p. 130. *Bruzel*, Obs. Char. pp. 12 and 22. *Greville*, Scottish Crypt. Fl. Vol. VI. p. 45, t. 339. Wilson in Suppl. to Engl. Bot. 1834, Vol. II. No. 2738. *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 356; in Flora, 1835, Vol. I. p. 71; Schweiz. Char. p. 20; Consp. Char. Europ. p. 6; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 923; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 408; and Fragm. Monog. Char. p. 174. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 680; and Atlas pl. 38, f. D; ed. ii. p. 891; and Atlas, pl.

42, f. D. *Kütz.* Phyc. Gener. p. 320; Phyc. Germ. p. 257; Sp. Alg. p. 521; and Tab. Phyc. Vol. VII. p. 21, t. 51, f. ii. and t. 52. *Ganterer*, Österr. Char. p. 15. *Babing.* in Ann. Nat. Hist. 1850, Vol. V. p. 90; and Man. ed. 8, p. 472. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 322. *Wahlst.* Bidr. Skand. Char. p. 32; and Monog. Sver. Norg. Char. p. 35. *Leonhardi* in Brunn Verhandl. Vol. II. p. 204. *H. & J. Groves* in Journ. Bot. 1880, p. 129, t. 207, f. 4. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 87. *Allen* in Bull. Torrey Bot. Club, Vol. IX. p. 43, pl. xxi. *Sydow*, Europ. Char. p. 85.

C. hispida, *Linn.* Sp. Pl. ed. i. p. 1156. *Horneman*, Fl. Danica, t. 1940. *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 17. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 44.

C. intertexta, *Desv.* in *Loisel. Deslongch.* Notice sur les Pl. à ajouter à la Fl. de France, p. 138.

C. canescens, *Loisel. Deslongch.* Notice, &c. p. 139.

C. galioides, and C. fallax, *Agardh*, Syst. Alg. Introd. pp. xxvii. and xxviii. (not C. galioides, *De Candolle*).

C. tenuispina, *A. Braun* in Flora, 1835, Vol. I. p. 68; Consp. Char. Europ. p. 7; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 409; and Fragm. Monog. Char. p. 181, t. vii. f. 267–268. *Kütz.* Phyc. Germ. p. 259. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 312. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 89. *Sydow*, Europ. Char. p. 92. C. tenuissima, *A. Braun* in Ann. Sciences Nat. 2nd ser. Vol. I. p. 355 (not of Desv.) is probably a misprint for C. tenuispina.

C. equisetifolia (*Nolte*), *Kütz.* in Flora, 1834, Vol. II. p. 705.

C. hirta, *Meyen*, in Linnæa, Vol. II. p. 78.

C. curta (*Nolte*), *Kütz.* Tab. Phyc. Vol. VII. p. 22, t. 53, f. i. *A. Braun*, Fragm. Monog. Char. p. 177.

"C. corallina, *Wallm.* in *Liljeblad*, Svensk. Fl. ed. 3" (Wallman).

Diœcious, [rarely monœcious]. Pale pea-green, or often greenish-grey or greenish-white, from being encrusted with carbonate of lime. Stem slender or very slender, rather brittle, translucent or opaque, when encrusted faintly striate, clothed with three times as many cortical cells as there are branchlets in a whorl, with numerous or few, scattered or fasciculate, spreading or retrorse, setaceous, acute, subpersistent spine-cells, situated on the primary cortical cells, especially in the upper part of the stem, but the spine-cells sometimes reduced to papillæ throughout, or at least on the lower part of the stem; subterranean part of the stem generally producing at the nodes 2 or 3, rarely 4, smooth, globose, 1-celled bulbils; stipule-cells in 2 whorls resembling the spine-cells, being very conspicuous when these are long, and papilliform when the latter are short or few. Branchlets 6 to 11 in a whorl, mostly 8, short, very slender, ascending or slightly incurved, 5- to 9-jointed; their joints clothed with cortical cells, except the minute mucro-like apical cell, which is naked, and sometimes also the second from the apex. Bracts in the female plant

8 to 10 in a whorl; the 5 inner ones longer, and usually exceeding the nucule; those on the outside of the branchlet shorter, and those at the upper nodes of the branchlet, which do not produce nucules, shorter, and often rudimentary. Bracts in the male plant usually shorter than in the female, and only 2 of them longer than the others, which are sometimes rudimentary. Nucules in the axils of the bracts, at 2 to 5 of the lowest nodes of the branchlet, oval-ovoid, deeply 12- to 14-striate, with a prominent erect-spreading persistent crown. Globules on separate plants from those bearing nucules, solitary in the axils of the bracts, at several of the lower nodes of the branchlets, [or rarely on the same plant and placed below the nucules (C. tenuispina).]

In lakes, ponds, and ditches, and more rarely in brackish pools; rather rare, but widely distributed, reaching from Cornwall and Hants, north to Orkney and Shetland; more common in Scotland; also more common in Ireland, where it extends from north to south of the island.

England, Scotland, Ireland. Perennial. Summer, Autumn.

Stems slightly branched, slender, often capillary, 3 inches to 1 foot long, with the internodes usually rather distant. Branchlets $\frac{1}{8}$ to $\frac{1}{2}$ inch long. The more spinous and condensed states resemble C. crinita, but the stems are much more faintly striate from the cortical cells being smaller; the bracts and stipule-cells are usually shorter and less spine-like, particularly the bracts towards the extremity of the branchlets; the nucules are much more strongly striate, and the whole plant is much more brittle when dry. The stouter states of C. aspera often much resemble small forms of C. hispida, particularly its var. pseudocrinita, [as for example *C. aspera* var. *dasyacantha*, A. Braun, in which the stem is densely covered with long setaceous spine-cells]; but the stems and branchlets are more slender, the cortical cells smaller, and the plant is diœcious, and usually of a much brighter green tint.

C. tenuispina, A. Braun (Char. Europ. Exsicc. No. 74), is doubtless a monœcious form, [the hermaphrodite plant,] variety, or at most subspecies, of C. aspera.

[Occasionally the spine-cells are reduced to mere rudiments like those of some states of C. fragilis, from which it is then difficult to distinguish this species. See remarks under C. fragilis.

One of the most marked forms is *C. fallax*, Ag., a small state in which the spine-cells are papilliform, and the branchlets variously ecorticate, sometimes having the lowest joint or joints clothed with cortical cells, and the rest naked, and sometimes having all the joints without cortical cells. The description given (Syst. Alg. Introd. p. xxviii.) is, by a typographical error, a repetition of that of C. collabens, as is stated by Agardh himself on the label of a typical specimen in the Kew Herbarium, there being no description of C. fallax.]

Rough Chara.

SPECIES IX.—CHARA FRAGILIS. *Desv.*

PLATES 1920 AND 1921.

Monœcious [or rarely diœcious]. Green, pale pea-green, more rarely greyish-green, from being slightly encrusted with carbonate of lime. Stem slender or very slender, very brittle, usually translucent, faintly spirally-striate, clothed with three times as many cortical cells as there are branchlets in a whorl, smooth, without spine-cells, [or the spine-cells very minute and wart-like or papilliform]; subterranean part of the stem sometimes producing bulbils at the nodes; bulbils consisting of an aggregation of cells, forming a subglobular, granulated mass. Stipule-cells in 2 whorls, papilliform, generally very minute, but the upper row sometimes conspicuously developed, and even spine-like. Branchlets 6 to 10 in a whorl, generally 7 or 8, short, or sometimes long, often slightly, [rarely (in var. β) strongly] incurved, slender, tapering, 7- to 13-jointed, their joints clothed with cortical cells, except the minute mucro-like apical cell, which is naked and sometimes also the second from the apex, [rarely all ecorticate]. Bracts mostly developed on the inner side of the branchlet; those at the fertile nodes usually shorter than the nucules, but not unfrequently 2 to 4 of them equalling or exceeding it, sometimes conspicuously so; those at the upper nodes of the branchlet, which do not produce nucules, shorter and often rudimentary, [rarely (in var. β) all absent or rudimentary]. Nucules in the axils of the bracts, at 2 to 5 of the lowest nodes of the branchlet, narrowly oval-ovoid, deeply 12- to 15-striate, with a long slender erect persistent crown, often abortive, and then shorter and indistinctly striate. Globule solitary, placed immediately below the nucule, [or on a separate plant].

[Var. *α. genuina.*

PLATE 1920.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. Nos. 13, 14, 15, 75, 100, 112, 115, 121.
Nordst. & Wahlst. Char. Scand. Exsicc. Nos. 115a, b, 116, 117, 118, 119, 120.
Chara fragilis, *Desv.* in *Loisel. Deslong.* Notice sur le Pl. à ajouter à la Fl. de France,

p. 137. *Bischoff*, Handb. Bot. Term. t. 57, f. 2806 and 2814. *A. Braun* in Ann. Sciences Nat. ser. 2, Vol. I. p. 356; in Flora, 1835, Vol. I. p. 68; Schweiz. Char. p. 21; Consp. Char. Europ. p. 7; in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 410; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 938; and Fragm. Monog. Char. p. 181. *Coss. & Germ.* Fl. Envir. Par. ed. i. p. 680; and Atlas, pl. 38, f. c; ed. ii. p. 890; and Atlas, pl. 42, f. c. *Kütz.* Phyc. Gener. p. 319; Phyc. Germ. p. 257; Sp. Alg. p. 521; and Tab. Phyc. Vol. VII. p. 22, t. 54. *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. 1845, dritte liefer. p. 16. *Ganterer*, Österr. Char. p. 20, t. ii. f. xv. *Babing.* in Ann. Hist. 1850, Vol. V. p. 91; and Man. ed. 8, p. 473. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 329. *Wahlst.* Bidr. Skand. Char. p. 38; and Monog. Sver. Norg. Char. p. 36. *Nordst.* in *Anderss.* Bot. Notiser, 1863, p. 42. *Crepin* in Bull. Soc. Bot. Belg. Vol. II. p. 126. *Leonhardi* in Brunn Verhandl. Vol. II. p. 207. *Lange*, Fl. Danica. t. 2796–2798 (six forms). *H. & J. Groves* in Journ. Bot. 1880, p. 101, t. 207, f. 1. *Müller* in Bull. Soc. Bot. Genève, 1881, p. 89, (13 forms described). *Allen* in Bull. Torrey Bot. Club, Vol. IX. p. 45, pl. xxii. *Sydow*, Europ. Char. p. 94.

C. globularis, *Thuill.* Fl. Envir. Par. p. 472.

C. capillacea, *Thuill.* Fl. Envir. Par. p. 474. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 330. *Kütz.* Tab. Phyc. Vol. VII. p. 23, t. 55, f. ii.

C. delicatula, *Desv.** in *Loisel. Deslong.* Notice, &c. p. 137; and Fl. de l'Anjou, p. 21. *Agardh*, Syst. Alg. p. 130. *Rupr.* in Beitr. zur Pflanz. des Russ. Reich. dritte liefer. p. 16. *A. Braun* in *Cohn*, Krypt. Fl. Schles. Vol. I. p. 411; and Fragm. Monog. Char. p. 184, t. vii. f. 269, 270.

C. pulchella, *Wallr.* Annus Bot. p. 184, t. ii. *Bischoff*, Krypt. Gewäch. p. 26, t. 1, f. 12, 13. *Berkeley* in Suppl. to Engl. Bot. 1843, Vol. III. No. 2824.

C. pilifera, *Agardh*, Syst. Alg. Introd. p. xxviii.

C. Hedwigii, *Agardh* in *Bruzel*, Obs. Char. pp. 7 and 21. *Berkeley* in Suppl. to Engl. Bot. 1834, Vol. II. No. 2762. *Kütz.* Tab. Phyc. Vol. VII. p. 23, t. 55, f. i.

"C. viridis, *Hartm.* Skand. Fl. ed. i. p. 378" (Wallman).

C. foliolata, *Hartm.* Skand. Fl. ed. 1843, p. 357.

C. virgata, and C. trichodes, *Kütz.* in Flora, 1834, Vol. II. p. 705; and Tab. Phyc. Vol. VII. p. 23, t. 56, f. i. ii.

C. fulcrata, *Ganterer*, Österr. Char. p. 20, t. ii. f. xvi. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 331.

"C. diffusa, *Wallm.* in *Liljeblad*, Svensk. Fl. ed. iii. addend." (Wallm.)

C. annulata, *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 328.

C. verrucosa, *Itzigsohn* in Bot. Zeit. 1850, p. 338.

Monœcious.

[* A. Braun and others consider *C. delicatula*, Desv. as distinct from *C. delicatula*, Ag., placing Desveaux's plant under *C. aspera*. They may be right, but there are no authentic specimens at Kew of either; yet from description they appear to be the same, and Desveaux himself in his Fl. de l'Anjou unites his *C. delicatula* with *C. fragilis*. The oldest name for *C. fragilis* is *C. globularis*, Thuill.; but as he also described it under another name (*C. capillacea*) in the same book, it is perhaps better to retain the name *C. fragilis*.]

Var. ? *β. connivens.*

PLATE 1921.

C. connivens (*Salzmann* herb.), *A. Braun* in Flor. 1835, Vol. I. p. 73; Consp. Char. Europ. p. 7; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 927; and Fragm. Monog. Char. p. 180. *Kütz.* Sp. Alg. p. 521; and Tab. Phyc. Vol. VII. p. 26, t. 63, f. i. *Wallm.* in Kongl. Vet. Akad. Handl. Stockh. 1854, p. 327. *Chaboisseau* in Bull. Soc. Bot. France, Vol. XVIII. p. 149, pl. 1. *Wahlst.* Monog. Sver. Norg. Char. p. 35, footnote. *Babing.* Man. ed. 8, p. 472. *H. & J. Groves* in Journ. Bot. 1880, p. 103, t. 207, f. 3. *Sydow*, Europ. Char. p. 89. *Coss. & Germ.* Atlas Fl. Envir. Par. ii. pl. 43.

C. connivens, var. Duriæi, *Kralik*, Pl. Alger. No. 154, and Pl. Tunet. No. 385 (exsicc.)*

Diœcious.]

In ponds, lakes, and ditches, &c., more rarely in running water.

[Var. *α.*—] Common and generally distributed; apparently more rare in Scotland, but extending north to Orkney and Shetland. In Ireland it occurs from south to north.

[Var. ? *β.*—Rare; Stokes Bay, Gosport, Hampshire; and Slapton Sands, near Dartmouth, Devonshire.]

England, Scotland, Ireland. Perennial. Summer, Autumn.

Stems 2 inches to 2 feet; slender, often capillary; the branchlets ¼ to ¾ or even, [in large forms,] 1–2½ inches long.

In the form C. Hedwigii, Agardh, the plant is dark green and much stouter than the ordinary form, sometimes nearly 2 feet long, and the branchlets ¾ to 2½ inches long; [a state of it in which all the joints of the branchlets are without cortical cells, has been collected near Blairgowie, East Perthshire, by Mr. A. Sturrock, and described as var. *Sturrockii* by Messrs. Groves in 'Journ. Bot. 1884,' p. 2.] The bract cells are extremely variable in length, sometimes much shorter than the nucule, and scarcely perceptible at the upper part of the branches; at other times they are all conspicuously longer than the nucule, but perhaps most generally there are 2 of the bracts equalling the nucule, and 2 shorter; [and on the branchlets of barren specimens they are frequently all rudimentary or absent.] The crusted forms are rare, and more brittle than the ordinary green form.

[* Kralik's specimens only differ from Salzmann's in being more slender. And *C. connivens*, var. *Duriæi*, *A. Br.* in Explor. de l'Algér. pl. 39, f. 2 (*C. concinna*, Durieu and Coss. in Bull. Soc. Bot. France, Vol. VI. p. 183, footnote; *C. Duriæi*, A. Br. in Monatsber. Akad. Wissensch. Berlin, 1867, p. 926; and Fragm. Monog. Char. pp. 22, 179, t. vii. f. 252–254, which are reduced copies of those in Explor. de l'Algér.); only appears to be a mere form in which the bracts are developed at nearly all the nodes of the branchlets; there is no specimen of it at Kew.—N. E. B.]

[C. connivens appears to be but a sexual state of C. fragilis, as strictly it only differs from that plant in sex; the greater incurving of the branchlets and shortness or absence of bracts given as distinctive marks are variable and unreliable characters. In the typical form of C. connivens (the branch and magnified portion of stem, with the more incurved branchlets represented on Plate 1921, which I have drawn from a typical specimen of Salzmann's in the Kew Herbarium), the branchlets are very much incurved and the bracts absent or rudimentary; but in the British specimens seen, the bracts are nearly half as long as the nucule, and the Slapton plant (a branch and magnified portion of a branchlet of which is shown on Plate 1921, taken from a specimen in the collection of Mr. Arthur Bennett of Croydon) has the branchlets only slightly incurved, whilst the Gosport specimen in Mr. Borrer's Herbarium (now at Kew) has only a few whorls of branchlets strongly incurved as in Salzmann's plant (not all of them as shown in 'Journ. of Bot.' 1880, t. 207, f. 3), and the rest but slightly incurved as in ordinary C. fragilis.]

C. fragilis bears a close resemblance to some states of C. aspera, but is without the very distinct spine-cells [characteristic of that species. Some forms of C. fragilis, however, have minute wart-like or papilliform spine-cells, and sometimes the spine-cells of C. aspera are reduced to a similar condition, it then becomes difficult to distinguish the two species, the only distinctive character (besides that of sex, on which no reliance can be placed) appears to be that of the bulbils; in C. aspera these appear to be always simple, consisting of a single, smooth, rather large, globose cell, and although two or more such bulbils may arise from the same node, they are not united to each other in a mass; whilst in C. fragilis the bulbils are always compound, consisting of numerous very small cells united into a granulated mass]. The globules in C. fragilis are brilliant scarlet, and contrast well with the bright green of the plant; they are very evanescent, and after their fall the specimen might be mistaken for the female of a diœcious species.

[The Kew Herbarium contains a specimen of C. fragilis from the hot springs of Iceland, on the label of which it is stated that, "the temperature of the spring in which this plant was growing was such as to boil an egg in four minutes." A remarkable fact *if* the water was really so hot *at the exact spot where the Chara grew*, as one would scarcely expect protoplasm to retain vitality at a temperature high enough to coagulate albumen.]

Fragile Chara.

SPECIES X. (?)—CHARA FRAGIFERA. *Durieu.*

PLATE 1922.

Braun, Rabenh. & Stiz. Char. Europ. Exsicc. No. 73a, b.
Chara fragifera, *Durieu* in Bull. Soc. Bot. France, 1859, Vol. VI. p. 185. *A. Braun,* Consp. Char. Europ. p. 7; in Monatsber. Akad. Wissensch. Berlin, 1867, p. 863; and Fragm. Monog. Char. p. 180. *Wahlst.* Monog. Sver. Norg. Char. p. 35, footnote. *Trimen* in Journ. Bot. 1877, p. 353, t. 192. *H. & J. Groves* in Journ. Bot. 1880, p. 102, t. 207, f. 2. *Babing.* Man. ed. 8, p. 473. *Sydow,* Europ. Char. p. 91.

Diœcious [or rarely monœcious*]. Bright green. Stem very slender, flexible, translucent, spirally striate, clothed with 3 times as many cortical cells as there are branchlets in a whorl, smooth without spine-cells; subterranean part of the stem producing bulbils at the nodes; bulbils consisting of an aggregation of cells, forming a subglobular, granulated mass; stipule-cells in 2 whorls, papilliform, generally very minute and inconspicuous. Branchlets 6 to 10 in a whorl, rather long, capillary, flexuous, rarely firm, ascending or slightly incurved, 10- to 16-jointed, their joints clothed with cortical cells, except the smaller apical cell, which is naked, and sometimes also the second, and even the third, from the apex. Bracts in the female plant 1 to 5 on the inner side of the branchlet, the longest of them about half the length of the nucule; those of the upper node of the branchlet, which do not produce nucules, rudimentary or absent. Bracts in the male plant usually 2, very minute and tooth-like. Nucules in the axils of the bracts, at 1 to 3 of the lowest nodes of the branchlet, oval-ovoid, deeply 11- to 13-striate, with a rather prominent erect or spreading, persistent crown; globules on separate plants from those bearing nucules, solitary between the minute bracts at several of the lower nodes of the branchlets, [rarely on the same plant, and placed immediately beneath the nucule].

In pools, very rare in West Cornwall and Tresco in the Scilly Isles. First found by Mr. J. Ralfs in 1877.

England. Perennial. Summer, Autumn.

A very delicate plant, 3 inches to 1 foot long, resembling the smaller states of C. fragilis; branchlets mostly ¾ to 1¼ inch long, resembling the filaments of a Conferva; more rarely, as in a plant from the Lizard Downs, $\frac{1}{4}$ inch long, and somewhat setaceous. Bracts shorter than in most forms of C. fragilis, particularly in the male plant; nucules with a shorter crown.

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* [According to Messrs. Groves ('Journ. Bot. 1882,' p. 350), and they are doubtless right, but I have not seen a monœcious specimen.—N. E. B.]

The bulbils of C. fragifera are remarkable for their large size, being $\frac{1}{10}$ to $\frac{1}{8}$ inch in diameter; they are formed of an aggregation of cells, and are white.

[C. fragifera bears a close resemblance to the more slender states of C. fragilis, and may possibly be only a distinct variety of that plant; it is, however, more slender, more flexible, the branchlets have more numerous joints, and the bulbils are usually larger and appear to be more unilateral with respect to the node they arise from, whilst on C. fragilis they seem more generally to grow out all round the node, though this may not be at all constant. With No 73b of Braun, Rabenh. and Stiz. Char. Exsicc., a specimen bearing unicellular bulbils is given as belonging to C. fragifera; but in the Kew set (and no doubt, from the statement made on No. 73a, in all other sets) this specimen is not C. fragifera at all, but C. aspera! of which such bulbils are characteristic, the specimen is partly decomposed; but where cortical cells remain on the stem, spine-cells are very evident, the branchlets are also those of C. aspera. Doubtless Durieu has been mistaken in the cases stated on No. 73a, in supposing the specimens with simple bulbils to be C. fragifera; he appears only to have found them on plants in a more or less decomposed condition, in which state the characteristics of C. aspera might easily be overlooked, especially if growing in a locality where C. fragifera was found.]

My British specimens of C. fragifera are through the Botanical Exchange Club, from Chy-an-hal, near Penzance, and Pond of Lizard Downs, Mr. J. Ralfs, and Gorkhill Down, Helston, Mr. J. Cunnack.

Strawberry Chara.

[Erratum.—For Arthur Bennett on p. 173, line 21, read A. W. Bennett.]

NOTE BY THE EDITOR,

Defining the sense in which certain terms have been employed in the descriptions of plants given in the Third Edition of 'English Botany.'

TERMS APPLIED TO GENERAL FIGURES OF PLANES.

Oval.—One and a half to twice as long as broad, broadest in the middle; sides curved.

Elliptical.—Three to four times as long as broad, broadest in the middle; sides curved.

Ovate.—One and a half to twice as long as broad, broadest between the base and the middle; sides curved.

Lanceolate.—Three to four times as long as broad, broadest between the base and the middle; sides curved.

Obovate.—Once and a half to twice as long as broad, broader between the middle and the apex; sides curved.

Oblanceolate.—Three to four times as long as broad, broadest between the middle and the apex; sides curved.

Oblong.—Two to three times as long as broad; sides parallel.

Strapshaped.—Four to six times as long as broad; sides subparallel.

Linear.—Eight or more times as long as broad; sides subparallel.

Rhombic.—Any figure which is broadest in the middle and with an angle on each side; the lines running from this angle to the base and apex being nearly equal and nearly straight.

Deltoid.—An equilateral triangle broadest at the base; sides nearly straight to the apex.

Triangular.—Limited to triangular figures of which the sides are conspicuously longer than the base.

Obdeltoid.—An equilateral triangle with its apex towards the base of the organ described.

Wedge-shaped.—A triangular figure (in the restricted sense defined above) with its apex towards the base of the organ described.

In most of these definitions some latitude is allowed in regard to their relative length and breadth, and when it becomes necessary to use more precise terms *broadly* or *narrowly* is employed to qualify them. Figures intermediate between two forms are called by the two terms answering to the forms, joined by a hyphen, the latter term being that to which the figure under consideration most nearly approaches. Thus *oval-obovate* denotes a figure which is nearer obovate than oval, and *obovate-oval* one which is more nearly oval than obovate. In every case these terms are used without reference to the shape of the base and apex, which is defined by terms in general use, such as *acute*, *obtuse*, *cordate*, *obcordate*, or to the nature of the margins, which is indicated by the generally received terms *entire*, *serrate*, *crenate*, *toothed*, etc. The word *cut* or *incised* is applied to the form of the margin when the general outline of the figure appears to have incisions made *into* it. The word *lobed* is used where there are protuberances extending *beyond* the general outline of the figure.

TERMS APPLIED TO THE GENERAL FIGURE OF SOLIDS.

Ovoid.—A solid whose transverse section is a circle, and its longitudinal section a figure longer than broad with curved sides. When it is necessary to define the shape more minutely, the figure of the plane found in the longitudinal section is prefixed to *ovoid*. Thus *ovate-ovoid* is a body whose longitudinal section gives an *ovate* figure.

Oblong-ovoid.—A solid of which the longitudinal section is *oblong-oval* or *oblong-elliptical.*

Cylindrical.—A solid of which the cross section is a circle and of which the longitudinal section is rectangular; the shape is defined by prefixing *oblong*, *strapshaped* or *linear.*

Fusiform.—A solid of which the transverse section is a circle, and its longitudinal section a *strapshaped-elliptical* or *linear-elliptical* figure.

Clavate.—A solid whose transverse section is a circle, and longitudinal section is a *strapshaped-oblanceolate* or *linear-oblanceolate* figure.

USE OF MARK OF INTERROGATION IN THE BODY OF THE WORK.

When a ? is placed *before* the word "subspecies" it implies that perhaps the plant ought to be treated as a species, and when before "var." the variety is perhaps a subspecies; but if the ? is placed *after* the words "species," "subspecies," [or "variety"], it denotes that the first should perhaps be considered a *subspecies*, the second a *variety*. [and the last as being probably a mere *form* or *condition*].

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[Species in CAPITALS, Sub-species in small letters, Synonyms and foreign names in *italics*.]

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——— Blue	1310	212	viii.
——— Boyton	1318	219	viii.
——— Crack	1306	207	viii.
——— Donian	1365	220	viii.
——— Downy Mountain, var. *a*	1368-1370	253	viii.
——— Dwarf	1356-1362	248	viii.
——— Flowering	933	99	vi.
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——— herb, Broad-flowered	499	13	iv.
——————— Chickweed-leaved	505	21	iv.
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——————— Lesser Alpine	507	23	iv.
——————— Long-podded square-stalked	502	17	iv.
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——————— Small-flowered hairy	498	12	iv.
——————————— -flowered smooth	501	15	iv.
——————— Spear-leaved	500	14	iv.
——— -leaved Inula	768	100	v.
——————— Pondweed	1404	34	ix.
——————— Spiræa	414	126	iii.
——— Rosemary-leaved French	491	7	iv.
——— Rose	464	206	iii.
——— White	1309	212	viii.
——— Wild French	495 & 496	10	iv.
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Wind Flower	11	13	i.
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——— Cress	120	171	i.
————— Early	124	176	i.
——— -green, Chickweed	1139	142	vii.
——————— Intermediate	897	49	vi.
——————— Lesser	898	50	vi.
——————— Round-leaved	895 & 896	48	vi.
——————— Serrated	899	51	vi.
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——— Heliotrope	781	118	v.
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——————— *Odermennig* (Ger.)		131	iii.
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——————— *Veilchen* (Ger.)		15	ii.

WOLF'FIA

	PLATE	PAGE	VOL.
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—— *Michel'ii*, Schleid.	1398	24	ix.
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Wollige Schlinge (Ger.)		204	iv.
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——————— Crowfoot	12	13	i.
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—— Brome-grass, False	1807	174	xi.
—— Calamint	1052	36	vii.
—— Chickweed	228	93	xi.
—— Club-rush	1602	70	x.
—— Couch-grass	1809	177	xi.
—— Cow-wheat	1005	187	vi.
—— Crane's-bill	296	195	ii.
—— Crowfoot	32	37	i.
—— Fescue-grass	1787 & 1788	149	xi.
—— Forget-me-not	1107	104	vii.
—— Germander	1093	85	vii.
—— Hawkweed	850	981	v.
—— Horsetail	1891	156	xii.
—— Hyacinth	1528	201	ix.
—— Meadow-grass	1768 & 1769	124	xi.
—— Melic-grass	1749	94	xi.
—— Millet-grass	1728	61	xi.
—— Nightshade	930	96	vi.
—— Sanicle	568	93	iv.
—— Sedge, Loose-spiked	1661	142	x.
—— —— Pendulous	1665	145	x.
—— —— Starved	1664	144	x.
—— Small-reed	1723	54	xi.
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—— Stitchwort	228	93	ii.
—— Vetch	387	91	iii.
—— Waxen	328	10	iii.
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—— Sweet	660	228	iv.
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—— Curved Alpine	1552	11	x.
—— Field	1551	9	x.
—— Great	1549	7	x.
—— Many-headed	1550	10	x.
—— Narrow-leaved Hairy	1547	5	x.
—— Spiked	1553	12	x.
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—— *alpi'na*, Newm.	1863	99	xii.
—— *Arron'ica*, Milde	1863	99	xii.
—— HYPERBO'REA, *R. Brown*	1863	99	xii.
—— —— var. *rufid'ula*, Koch	1862	98	xii.
—— ILVEN'SIS, *R. Brown*	1862	98	xii.
—— *Raia'na*, Newm.	1862	98	xii.
—— *rufid'ula*, Beck	1862	98	xii.
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Yorkshire Fog	1744	85	xi.
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—— *pédonculée* (Fr.)		57	ix.
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—— PALUS'TRIS, *Linn.*	1425, 1426	56	ix.
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—— MARI'NA, *Linn.*	1429 & 1430	60	ix.
—— —— Reich.	1429	60	ix.
—— —— var. angustifolia, *Fries*	1430	60	ix.
—— *mi'nor*, Nolte	1431	61	ix.
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——— *Holunder* (Ger.)		201	iv.
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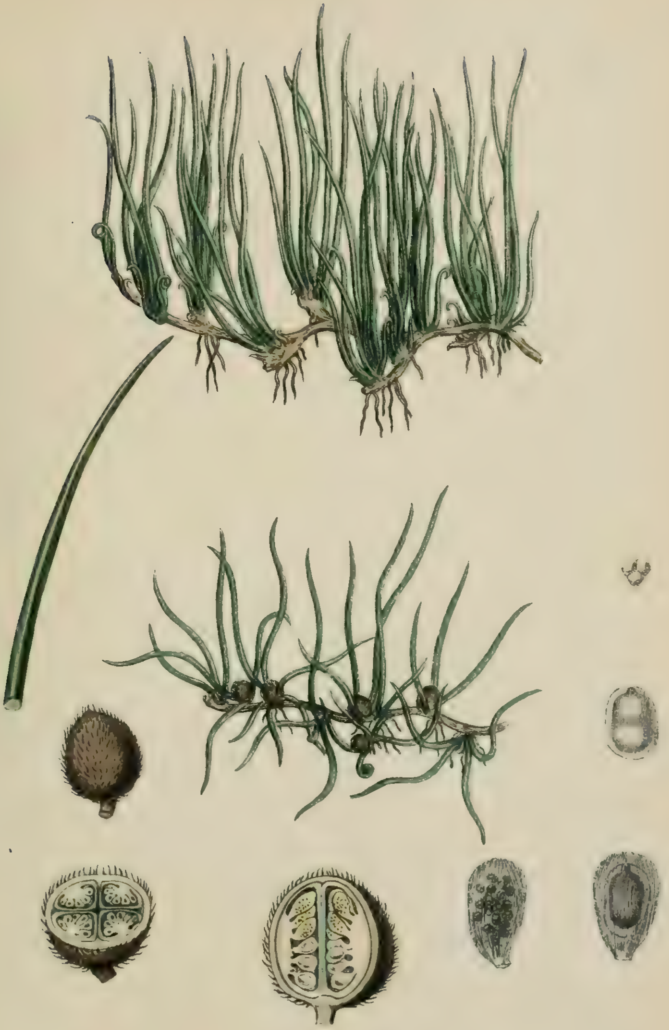
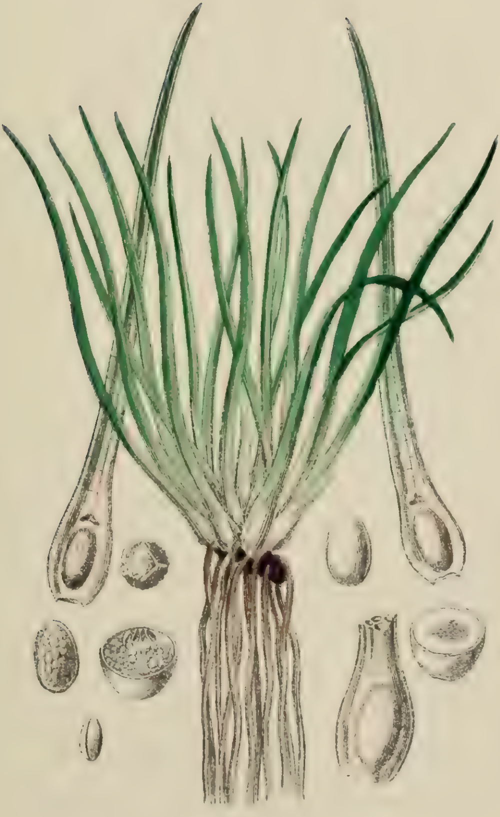
ENGLISH BOTANY.

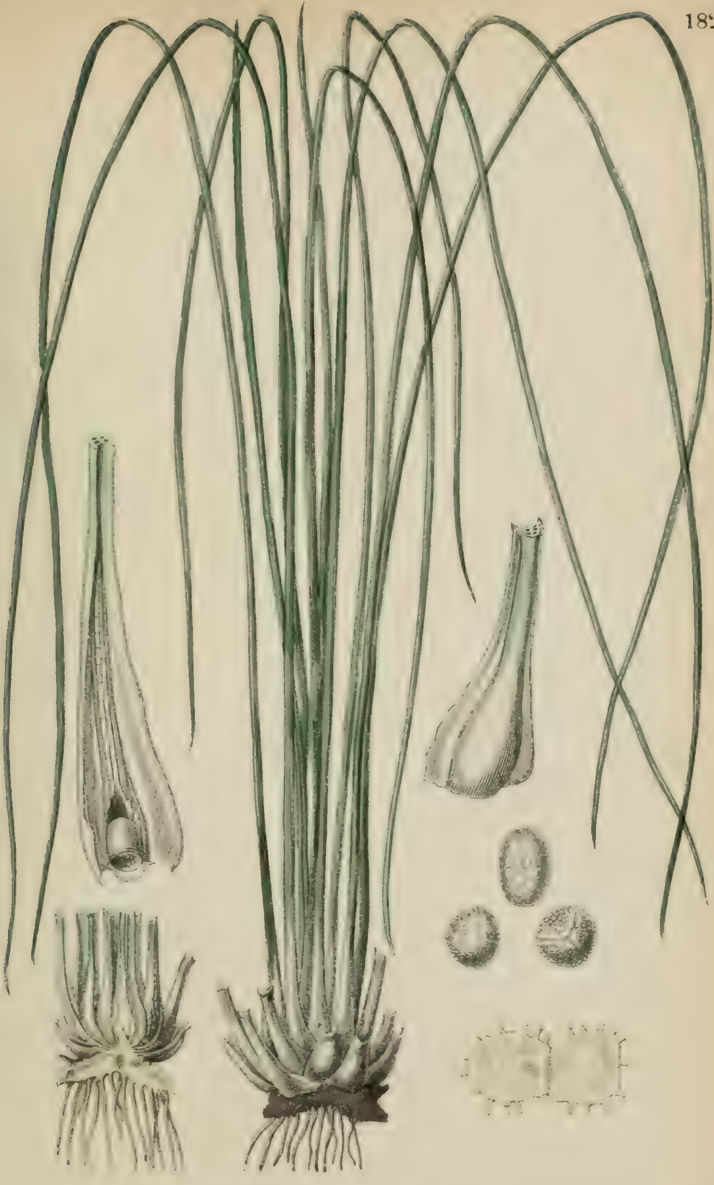
ILLUSTRATIONS.



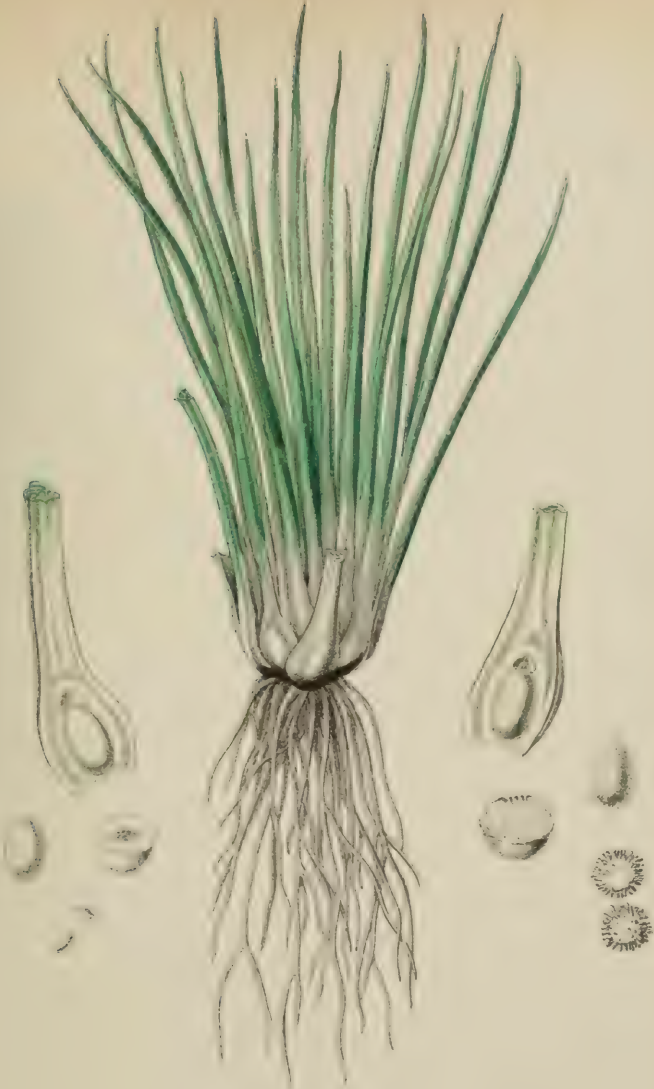
E.B. 521 Pilularia globulifera.



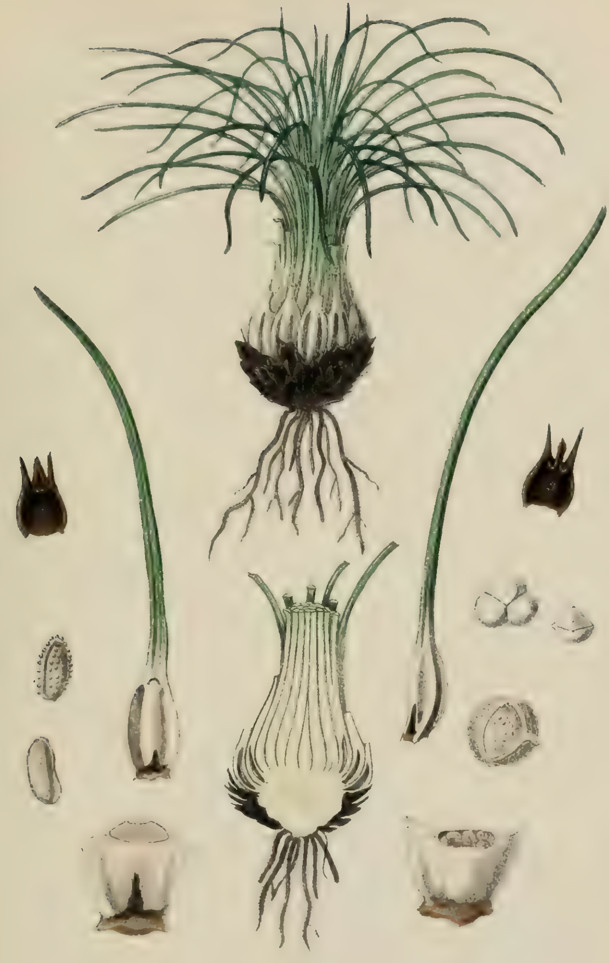
E.B. 1084 Isoetes eu-lacustris.



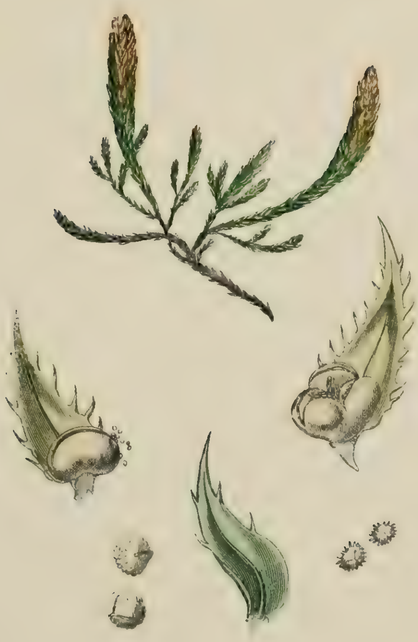
Isoetes eu-lacustris. *var Morei*



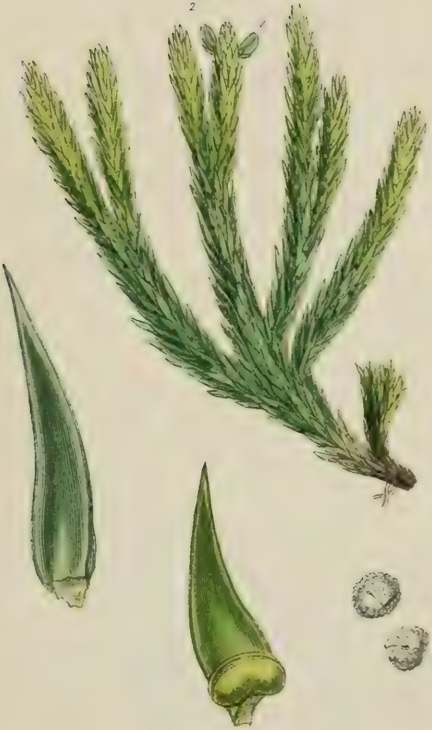
Isoetes echinospora.



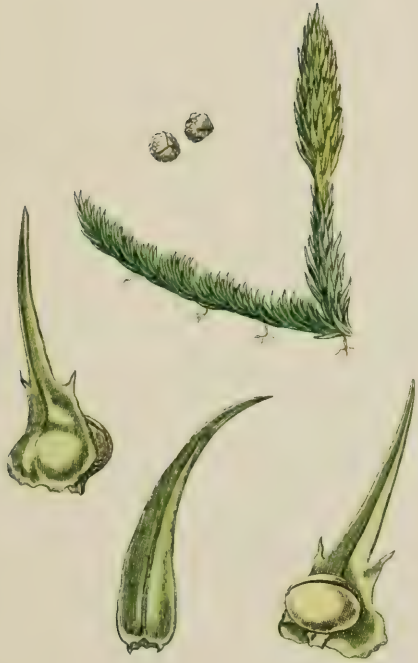
Isoetes Hystrix.



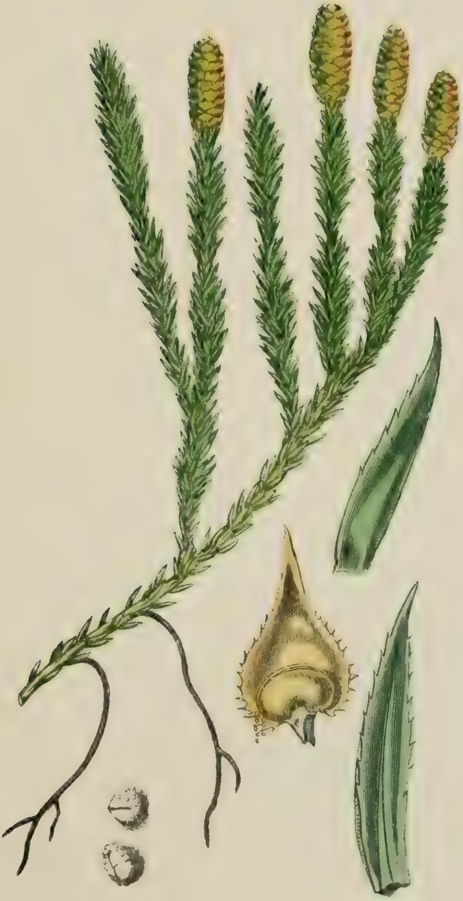
E.B. 1148 Selaginella selaginoides.



E.B. 233 Lycopodium Selago.

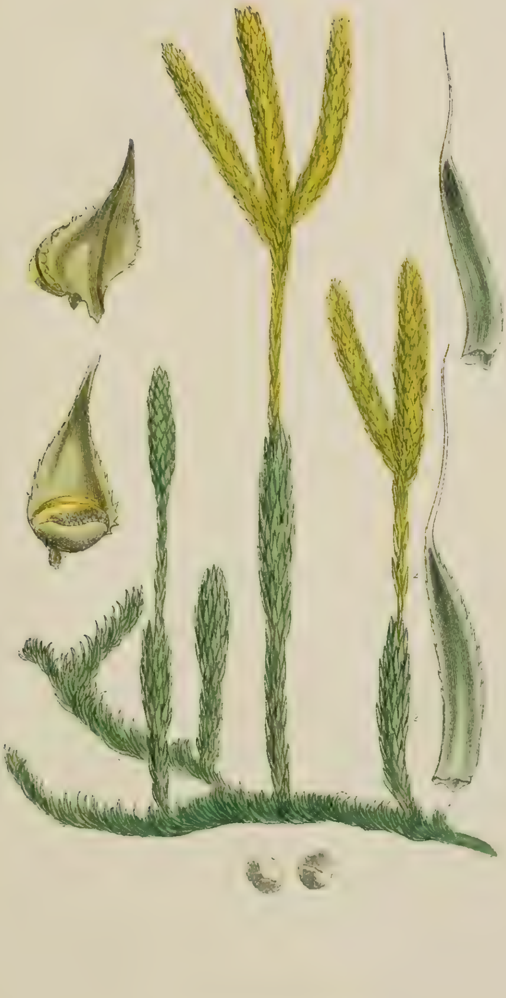


E.B. 239 Lycopodium inundatum.



E B. 1727

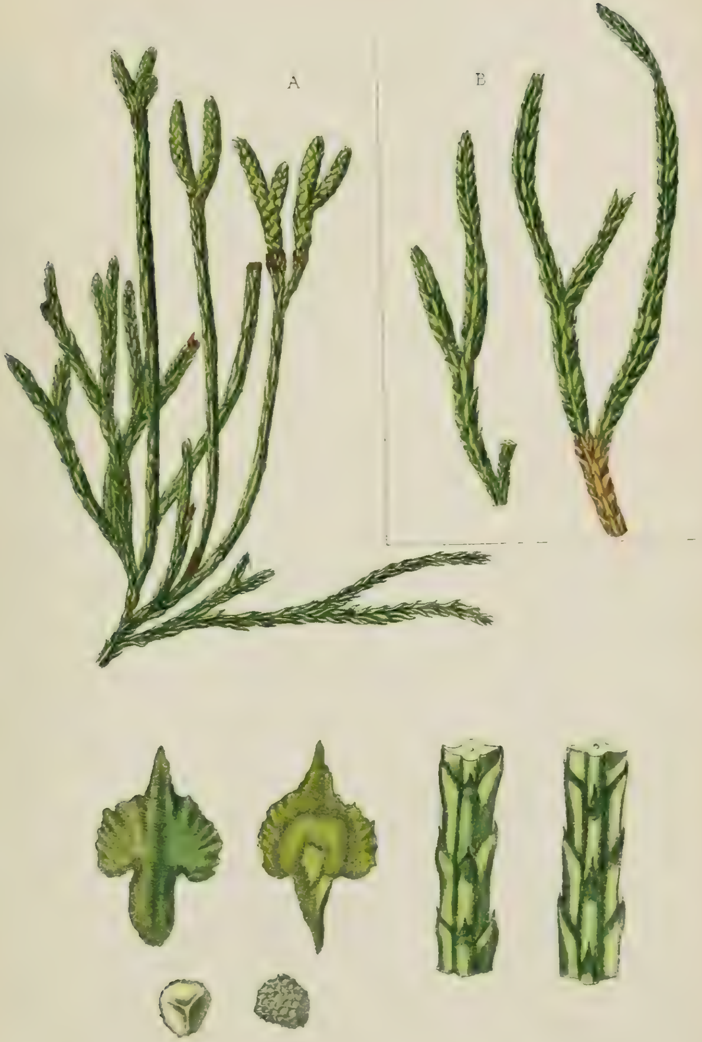
Lycopodium Annotinum.



E.B. 224 Lycopodium clavatum.

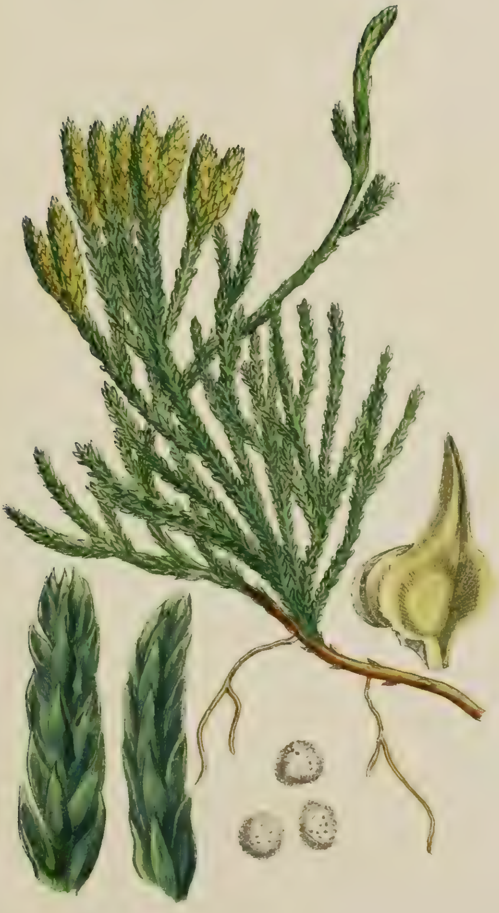
This Plate should be inserted
in Part 84.

1834*

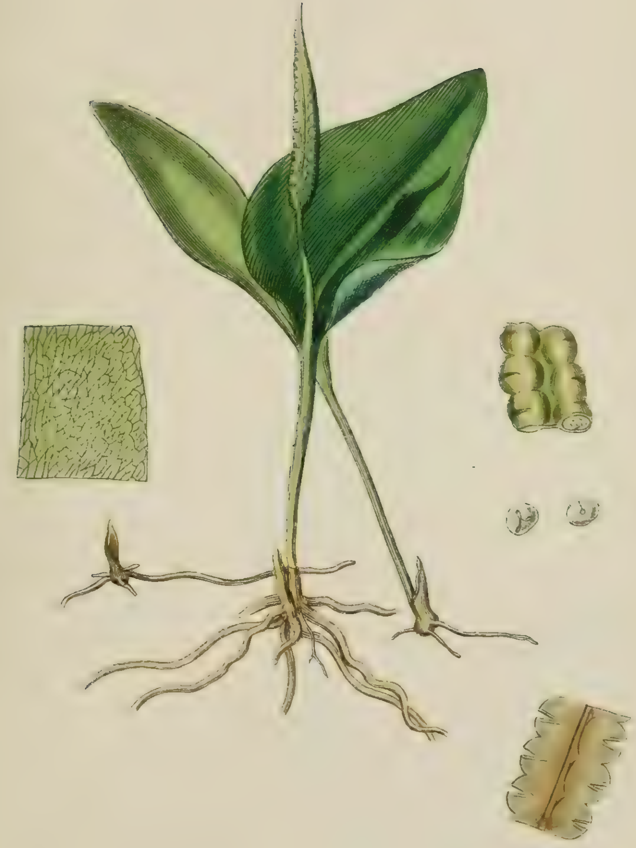


A. Lycopodium alpinum var. decipiens.

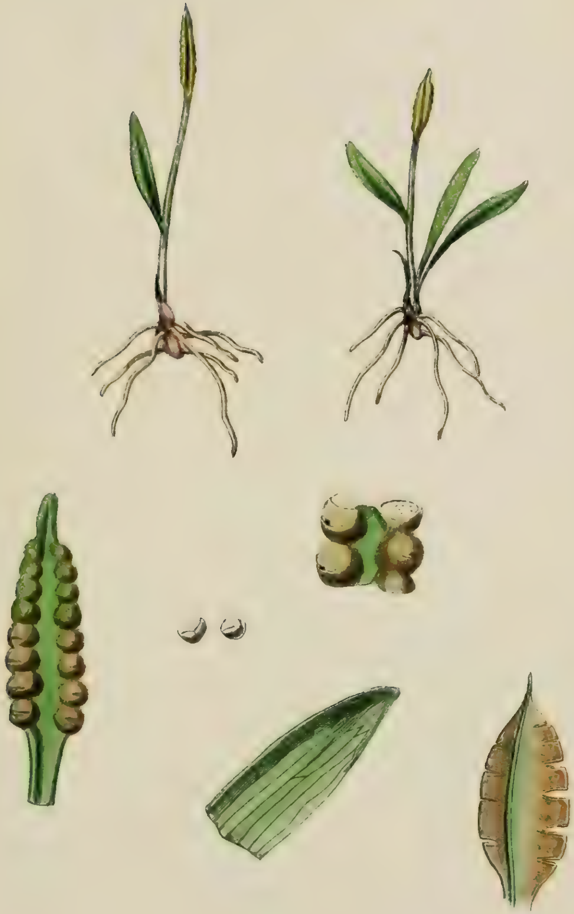
B. Lycopodium complanatum var. anceps.



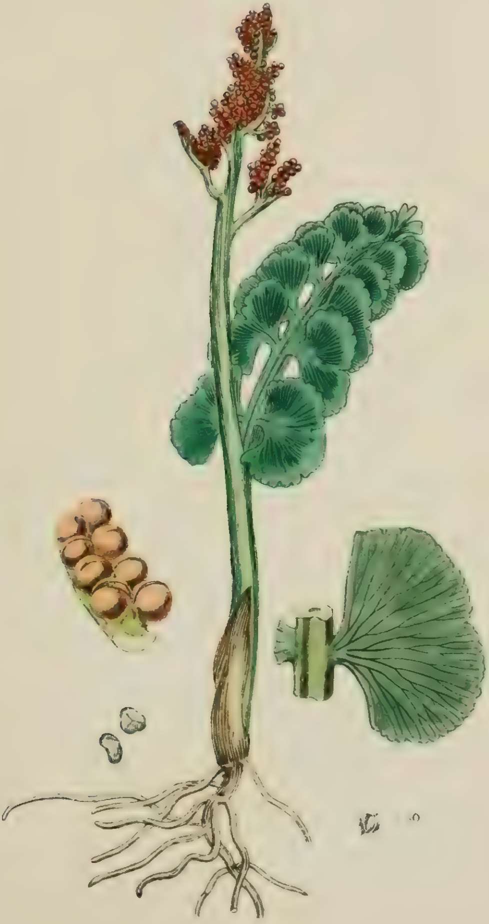
E B. 234 **Lycopodium Alpinum.**



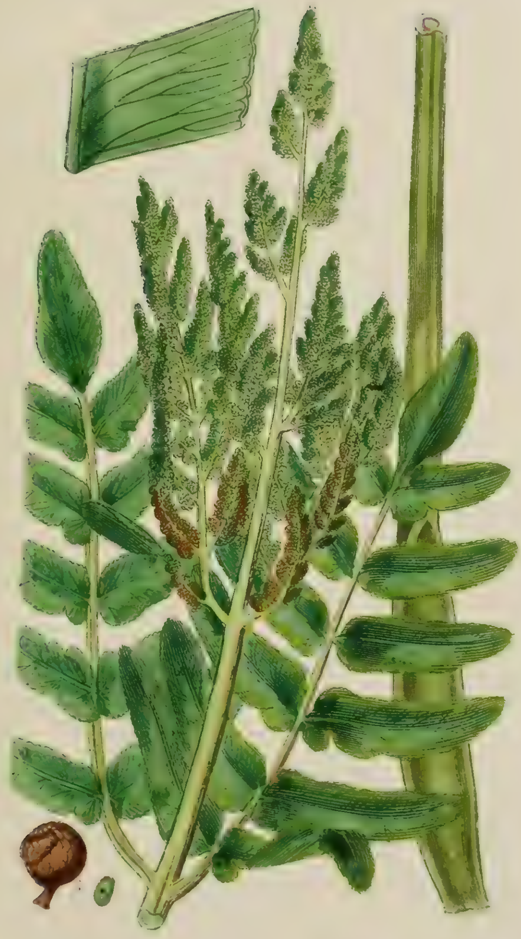
E.B. 108 Ophioglossum vulgatum.



S.B.F. 47 Ophioglossum Lusitanicum.

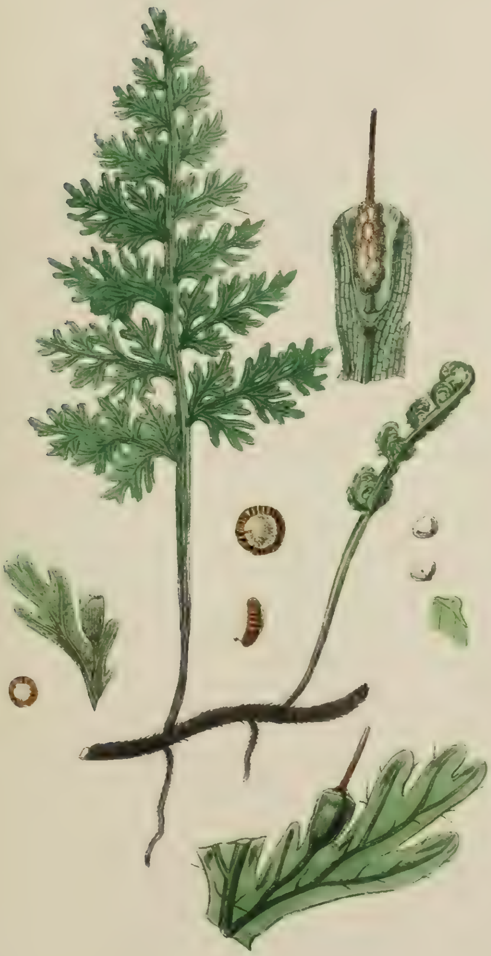


E.B. 318 Botrychium Lunaria.

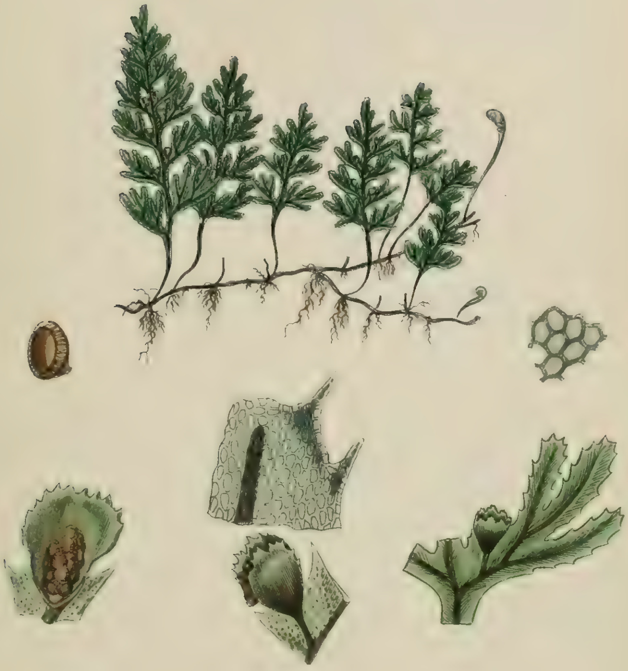


E.B. 209

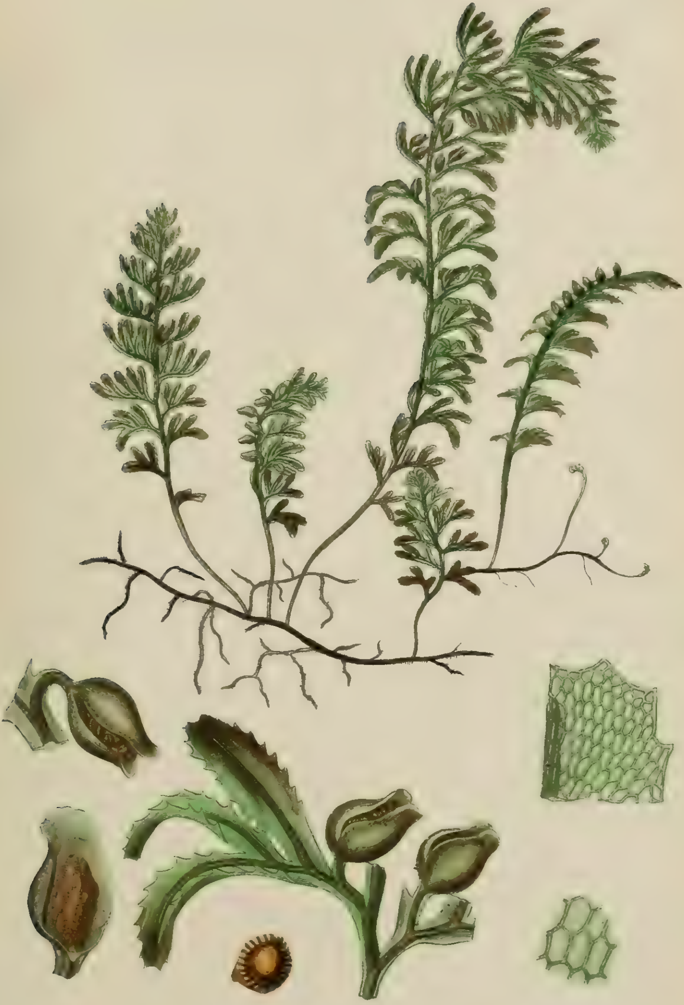
Osmunda regalis.



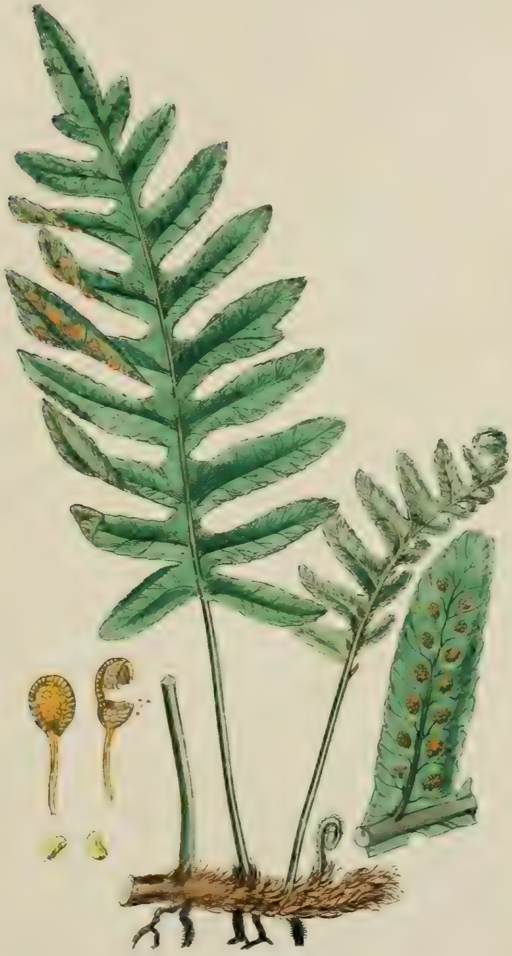
E.B. 1417 Trichomanes radicans.



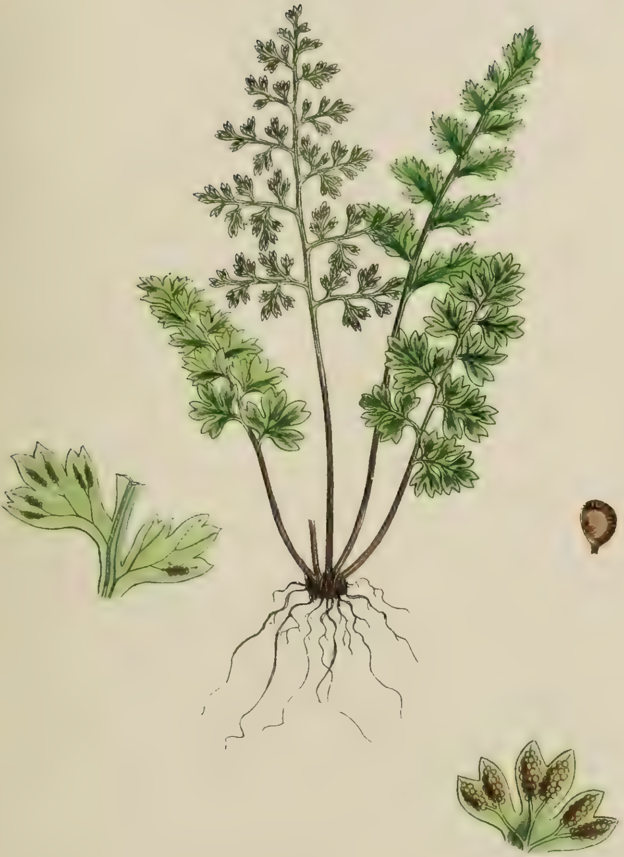
E.B. 162 Hymenophyllum Tunbridgense.



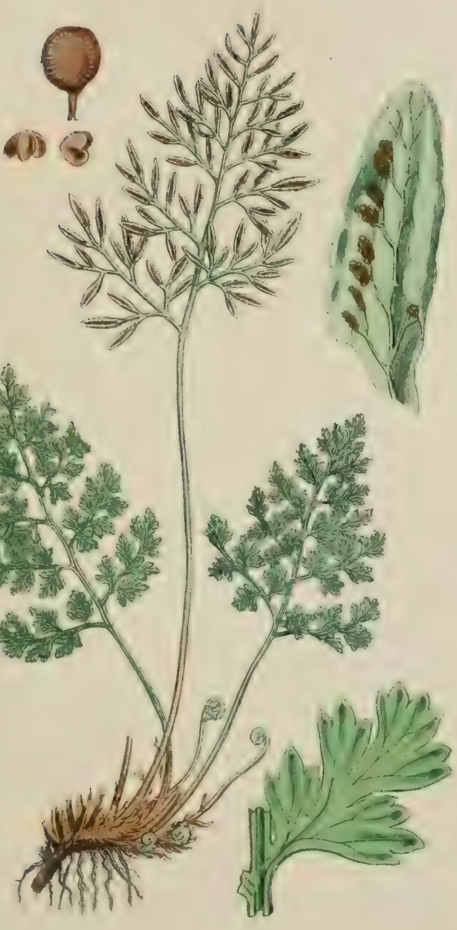
E B.S. 2686 Hymenophyllum unilaterale.



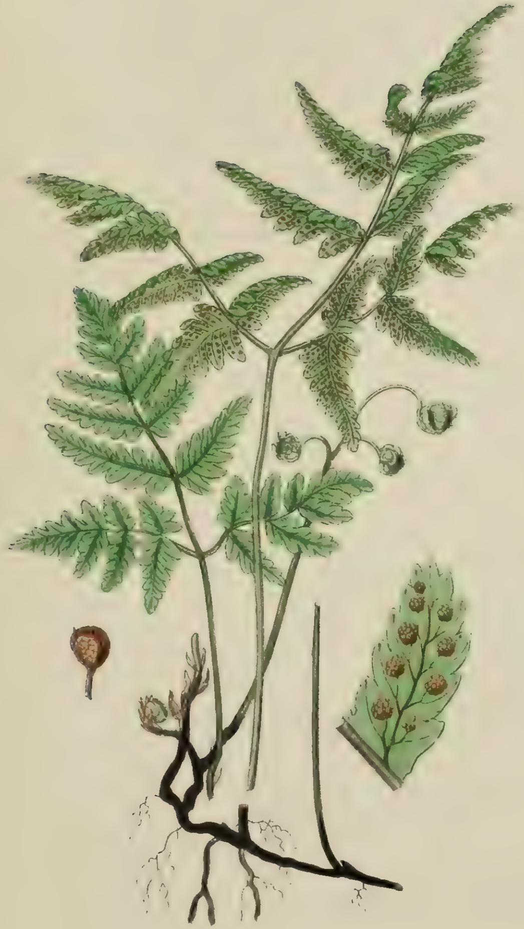
E.B. 1149 Polypodium vulgare.



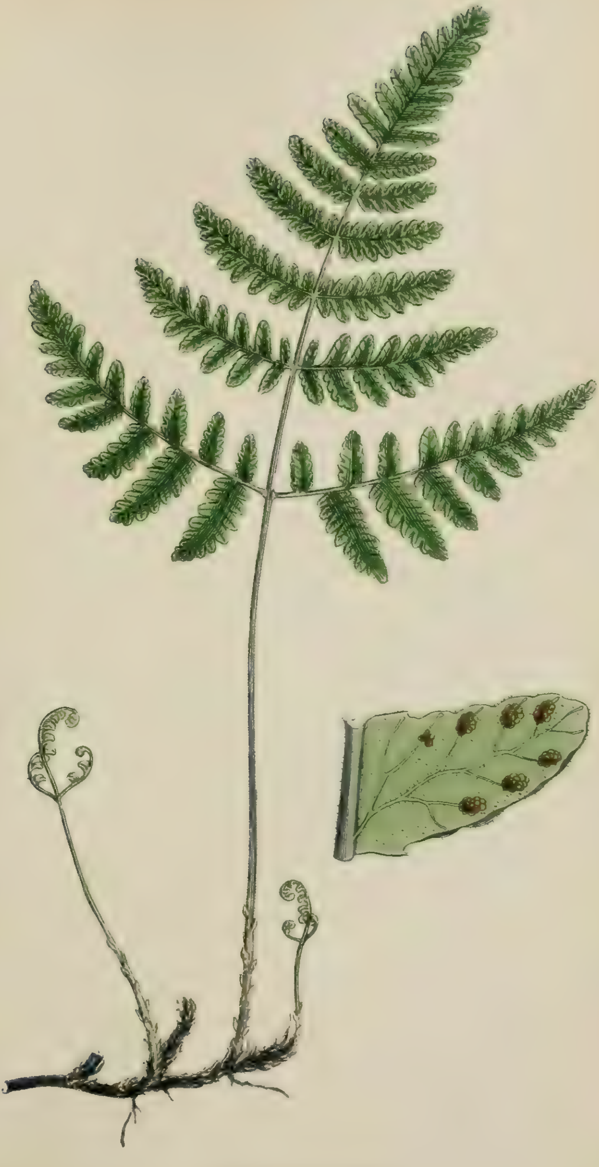
S.B.F. 48 Gymnogramma leptophylla.



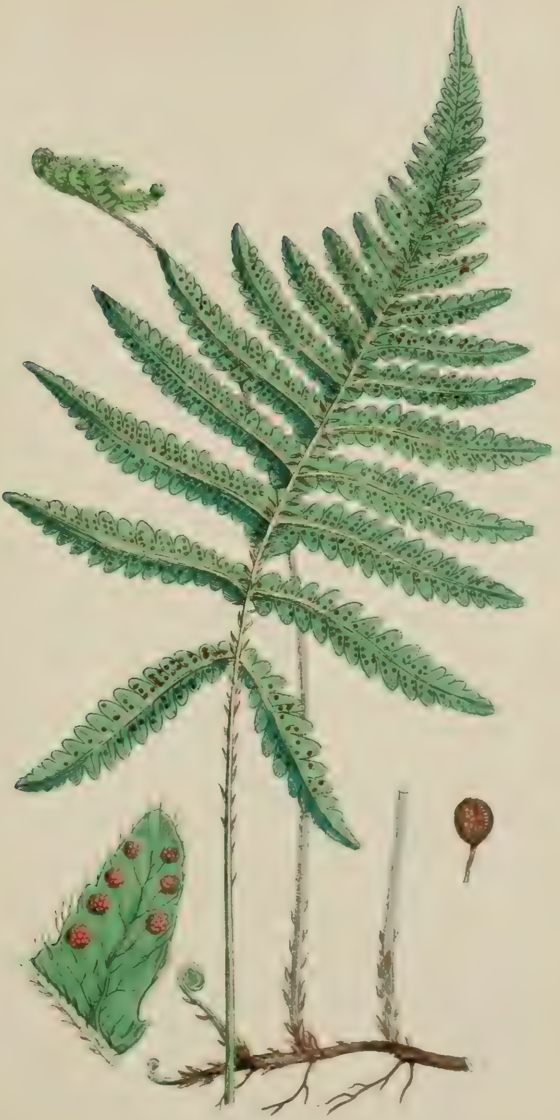
E.B. 1160 Cryptogramme crispa.



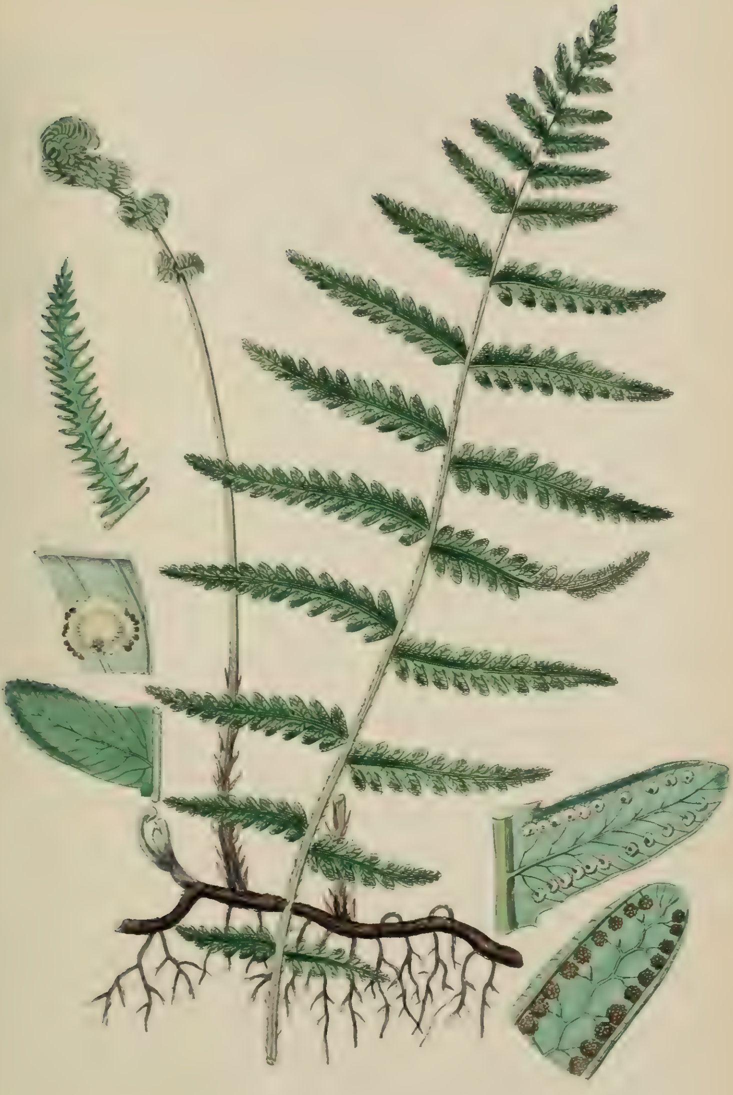
E.B. 616 Phegopteris Dryopteris.



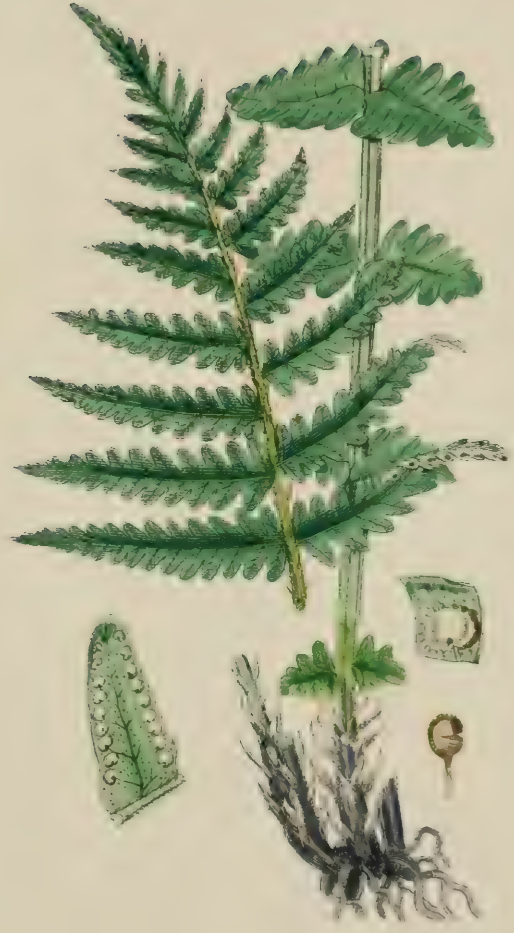
S.B.F. 4 Phegopteris Robertiana.



E.B. 2224 Phegopteris polypodioides.

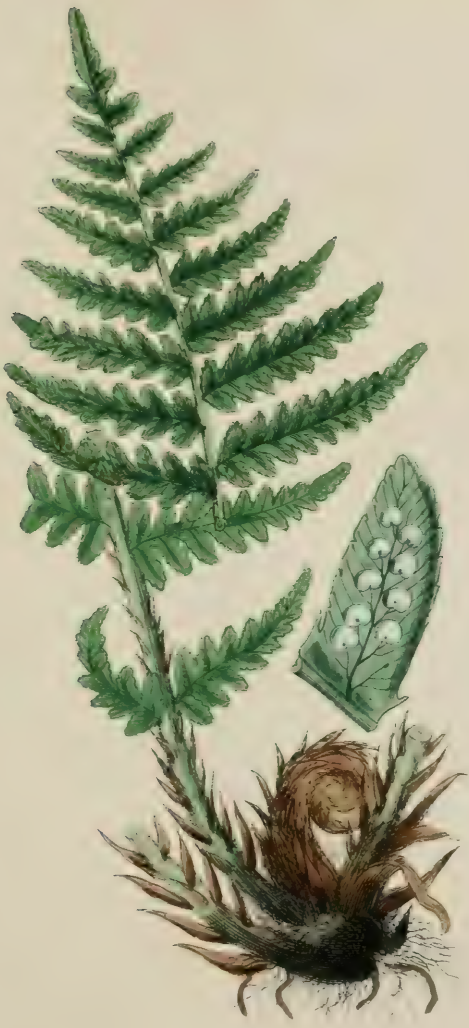


Lastrea thelypteris.



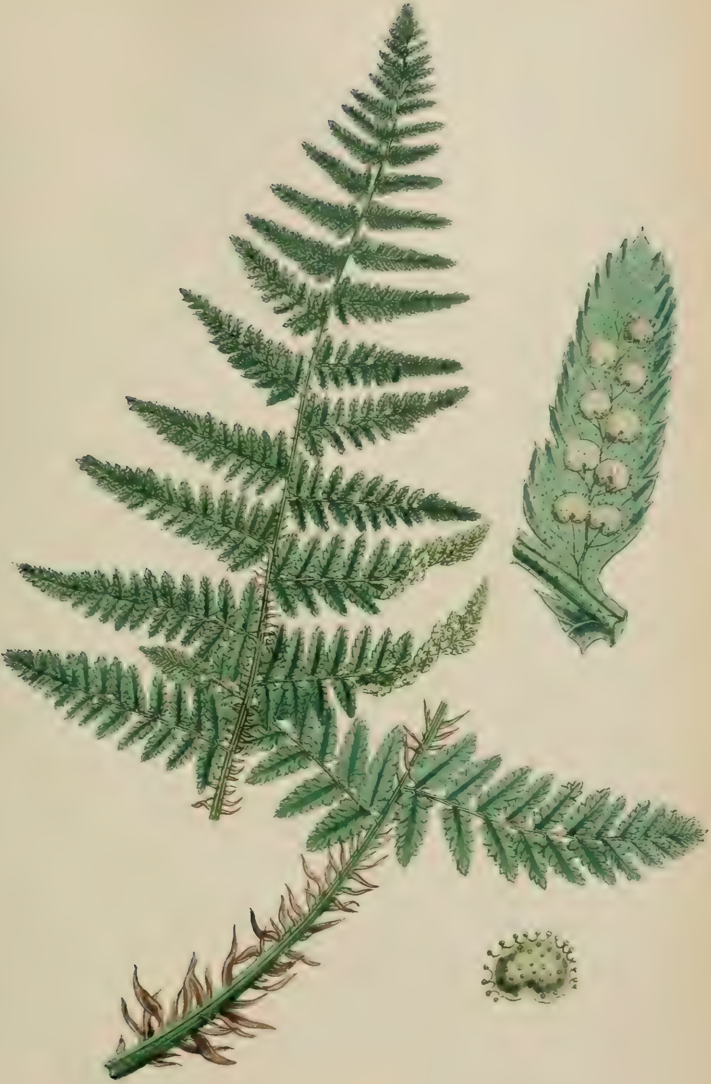
E B 1019

Lastrea orespteris.



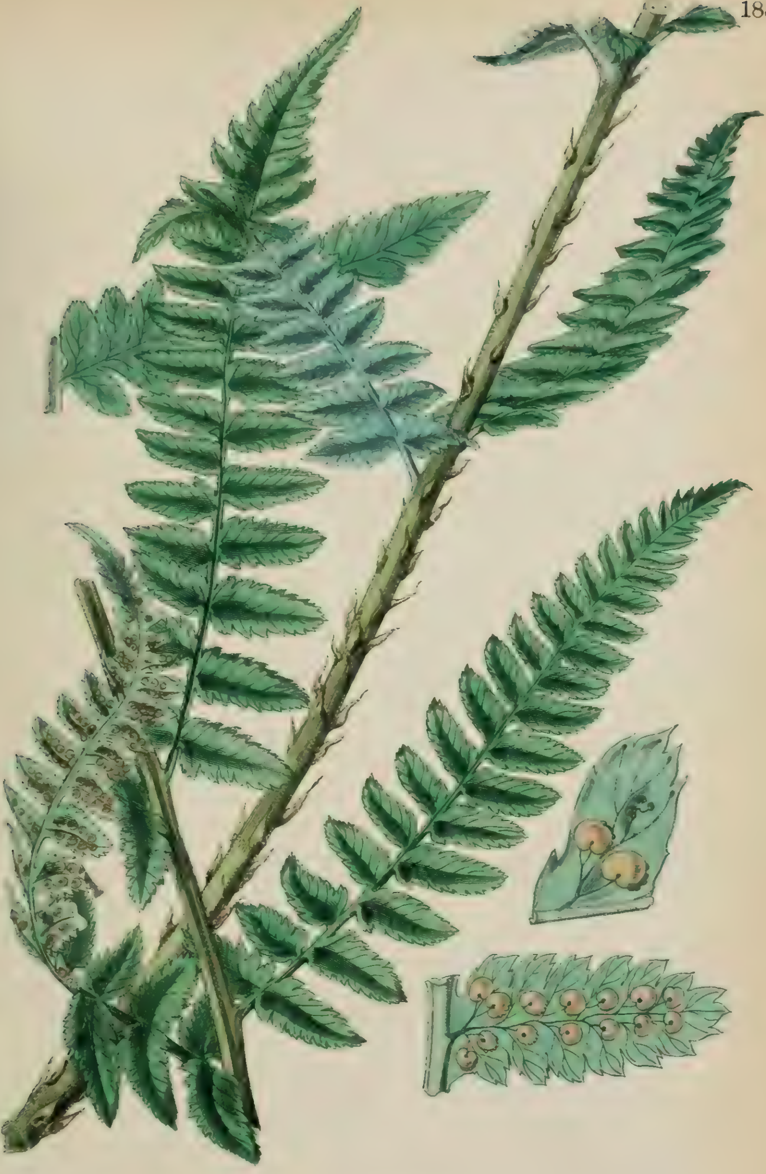
E.B. 1458

Lastrea filix-mas.

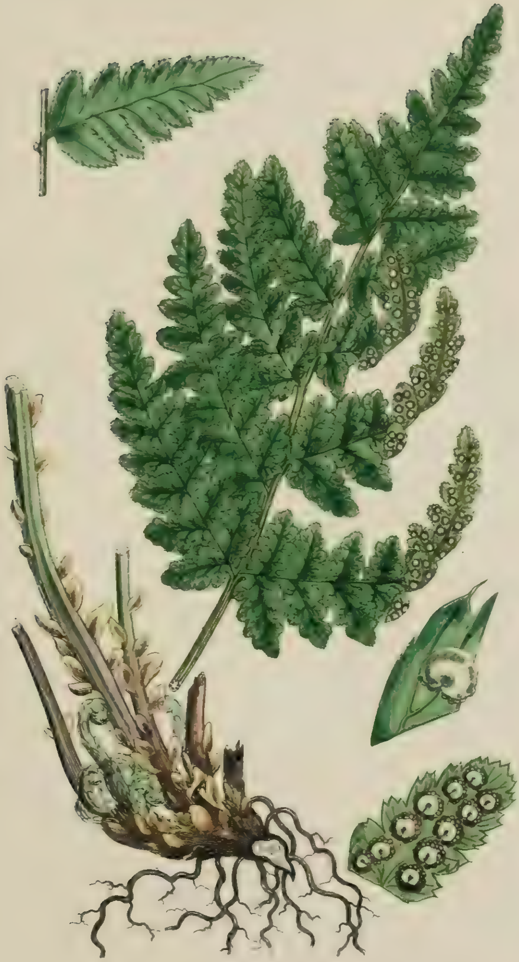


E.B.S. 2724

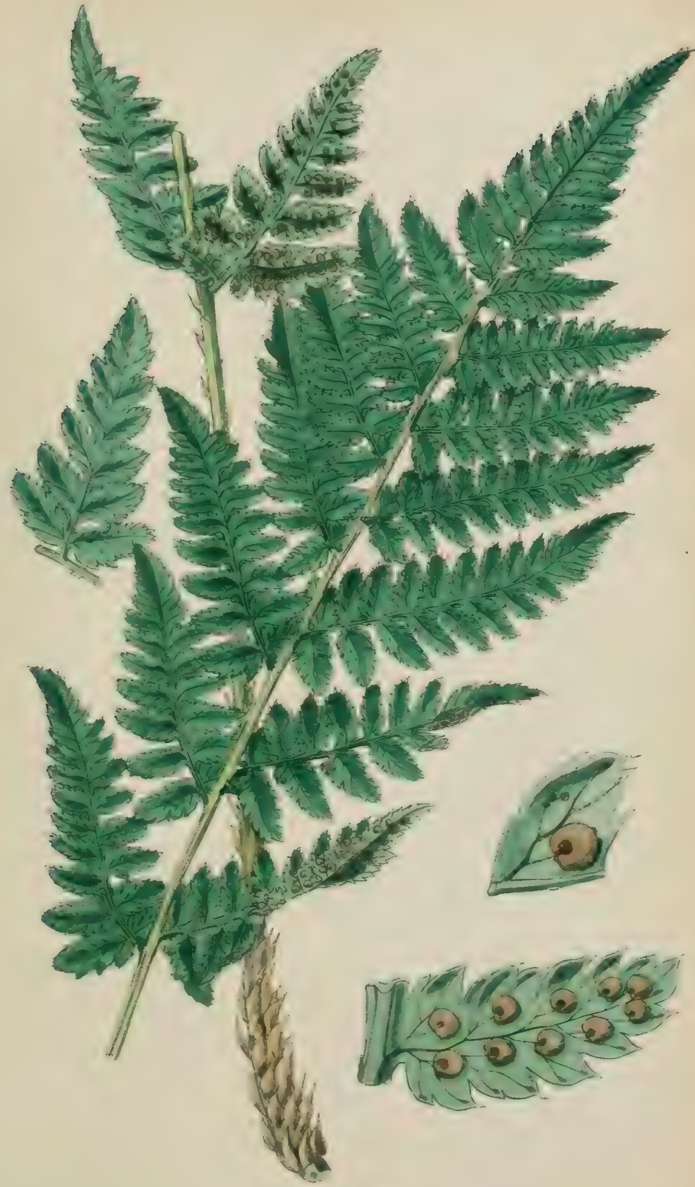
Lastrea rigida.



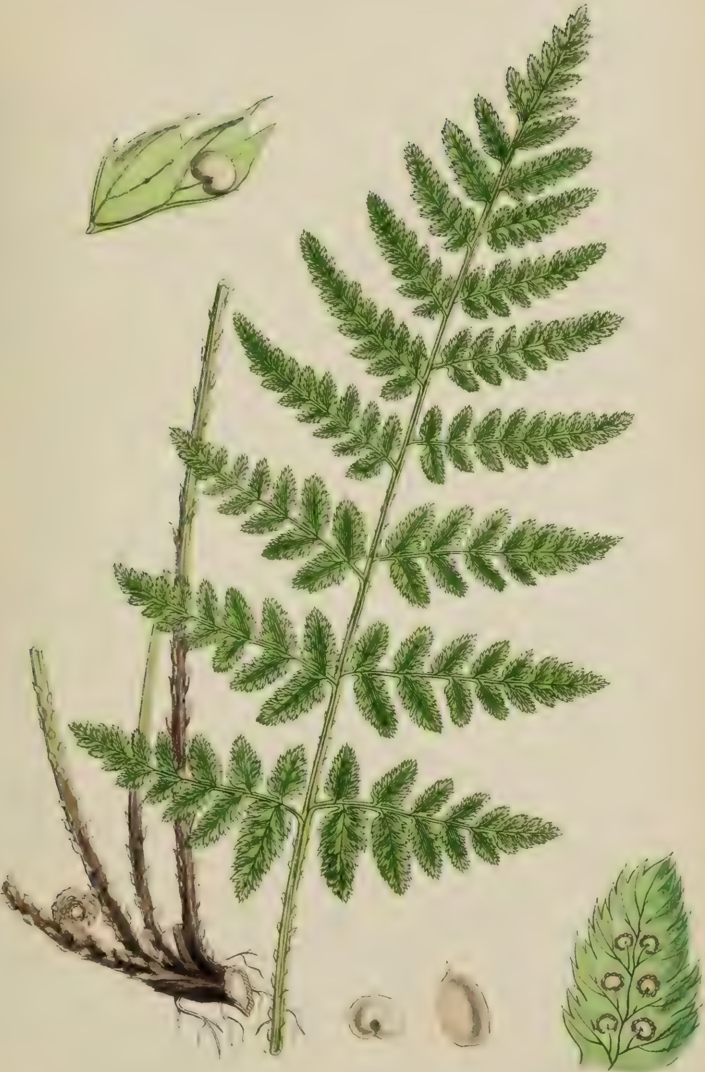
Lastrea remota.



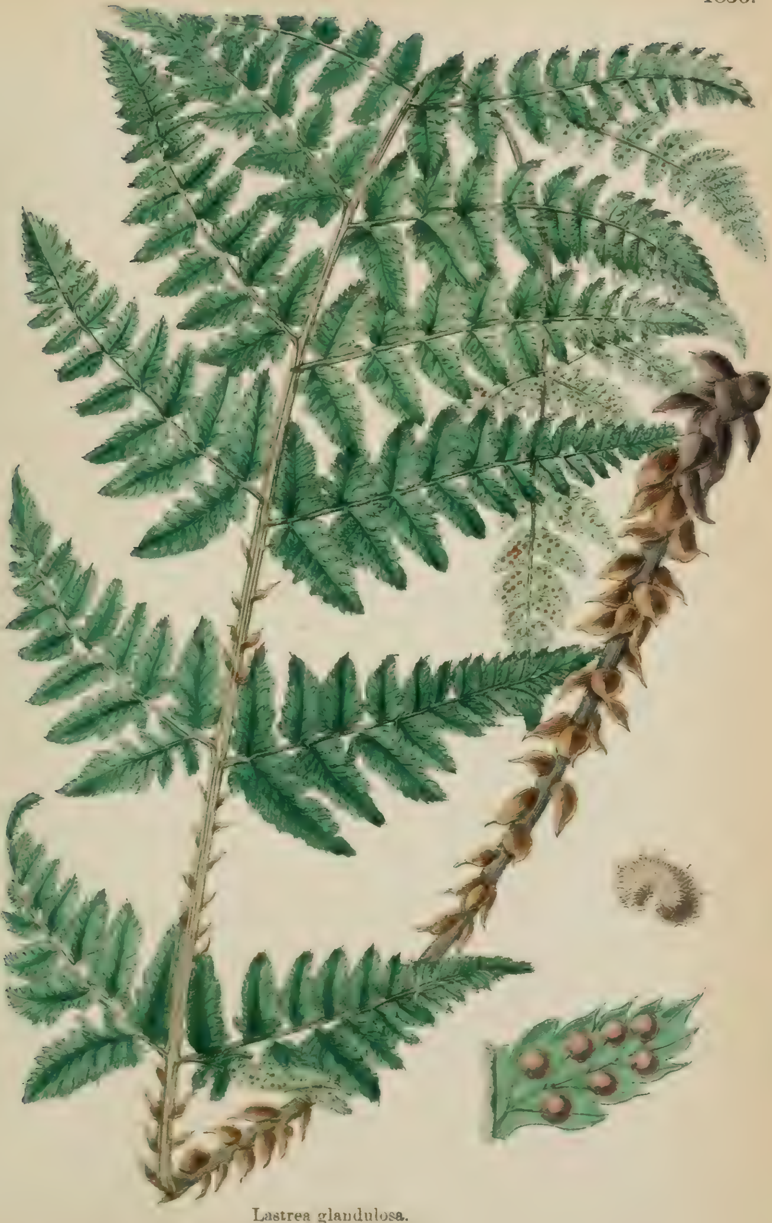
E.B. 2125 Lastrea cristata.



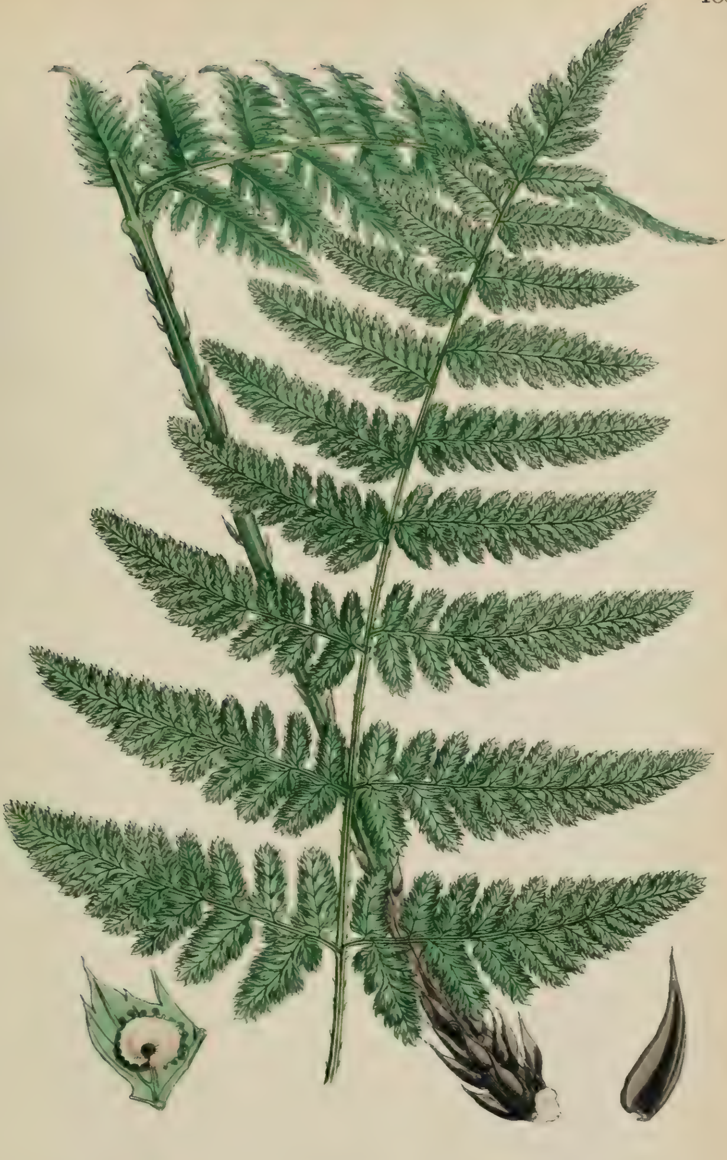
Lastrea uliginosa.



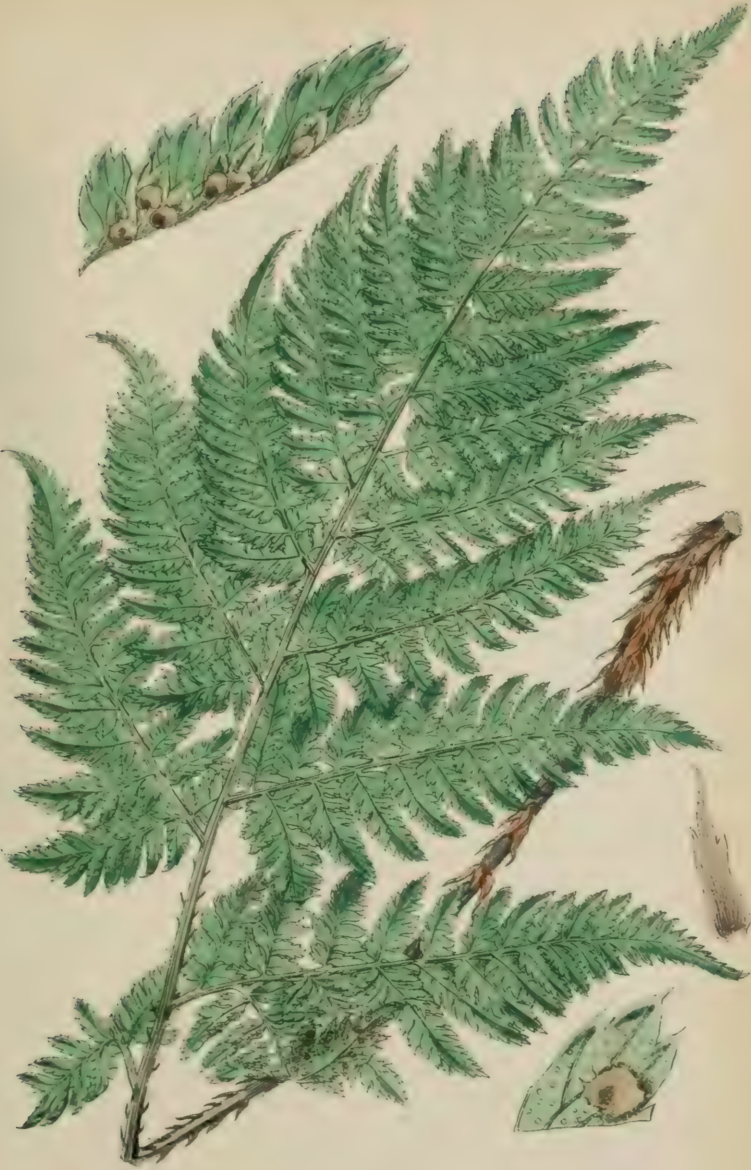
Lastrea spinulosa.



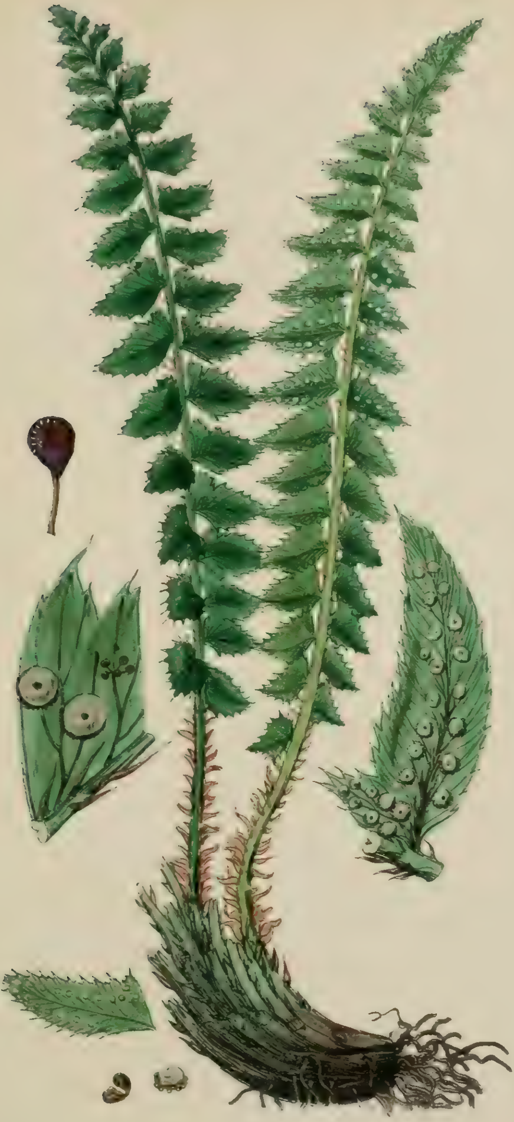
Lastrea glandulosa.



Lastrea dilatata.

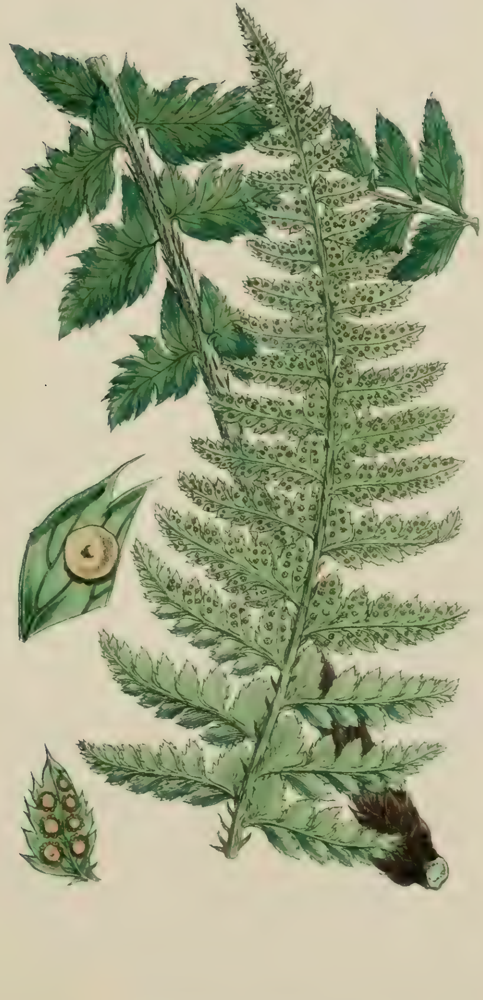


Lastrea aemula.



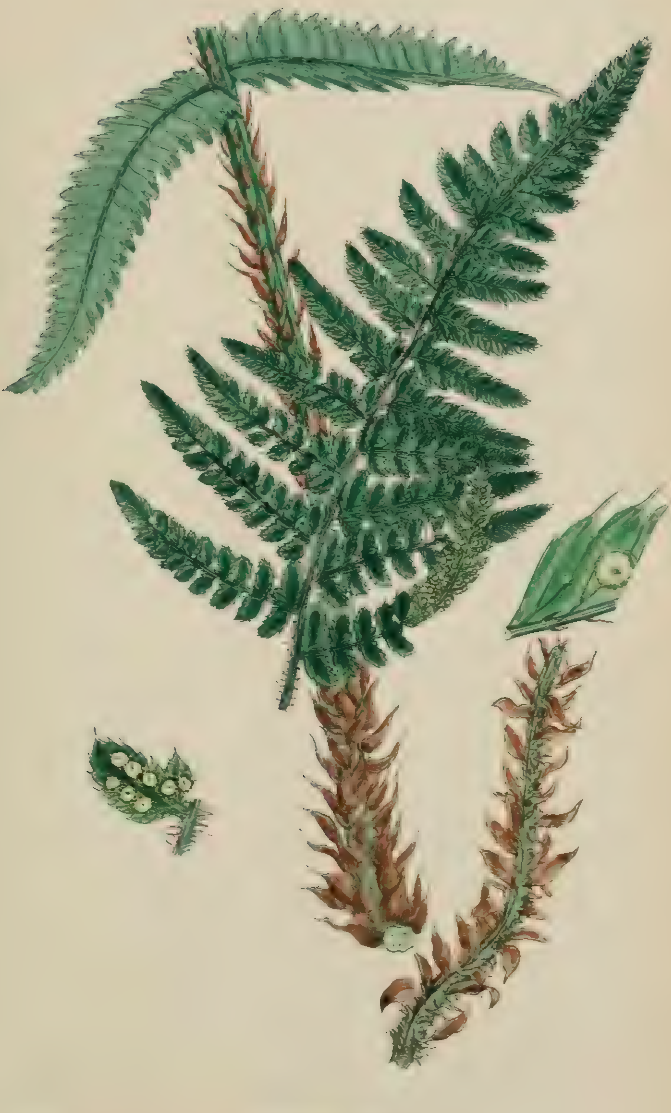
E.B. 797

Polystichum lonchitis.



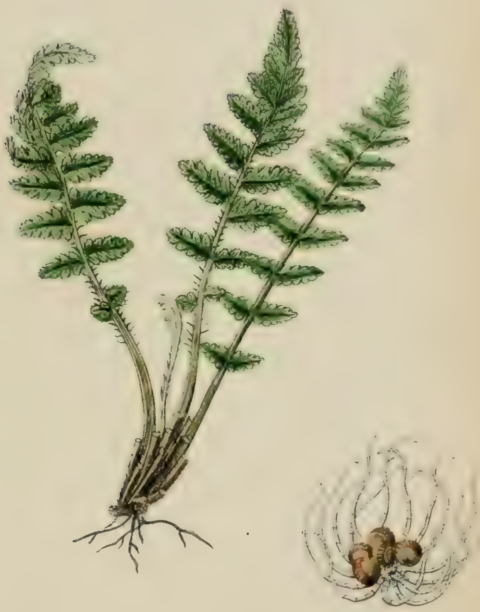
E.B. 1563

Polystichum lobatum.

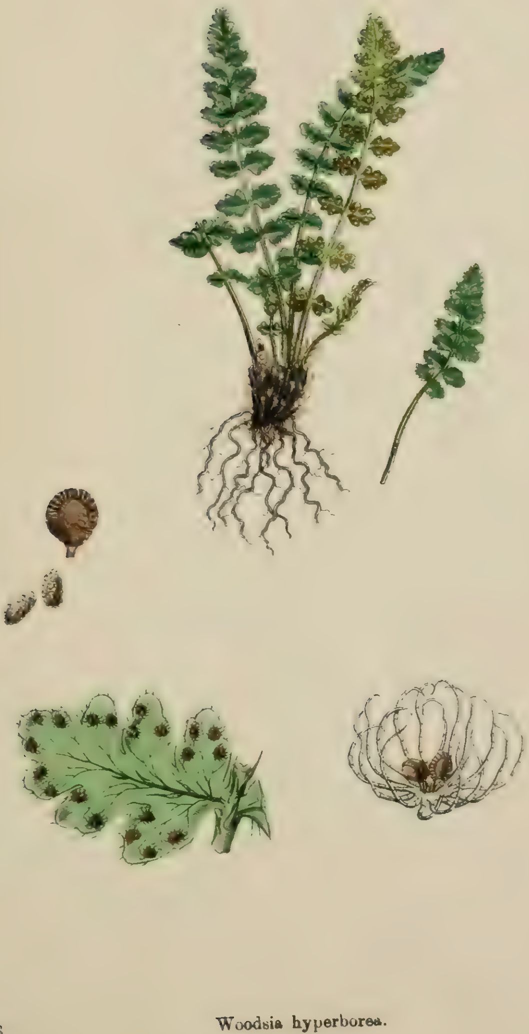


E.B.S. 2776 Polystichum angulare.

1862.

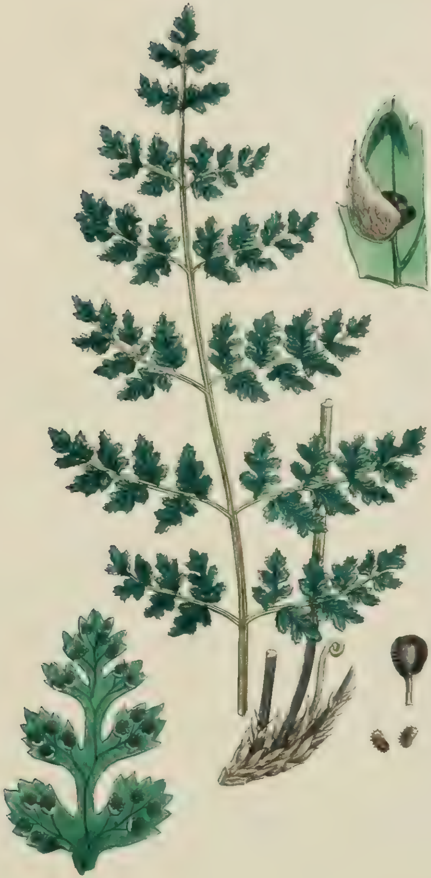


E.B.S. 2616 Woodsia ilvensis.

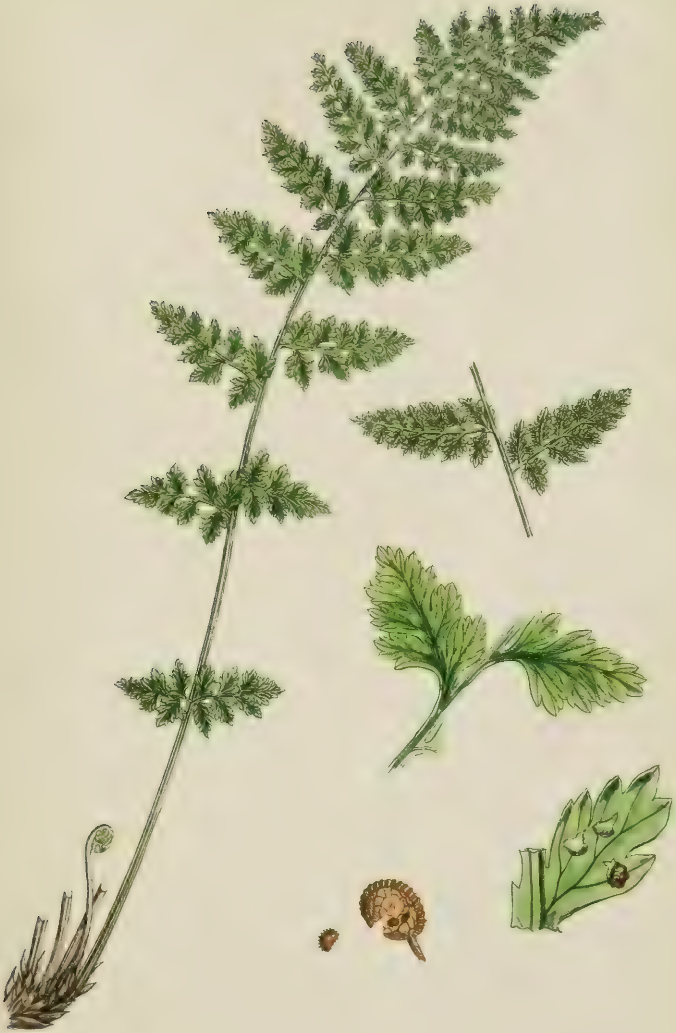


E.B. 2023

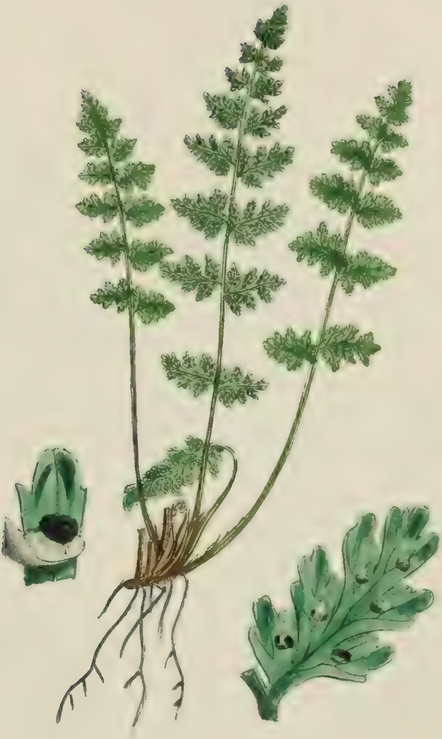
Woodsia hyperborea.



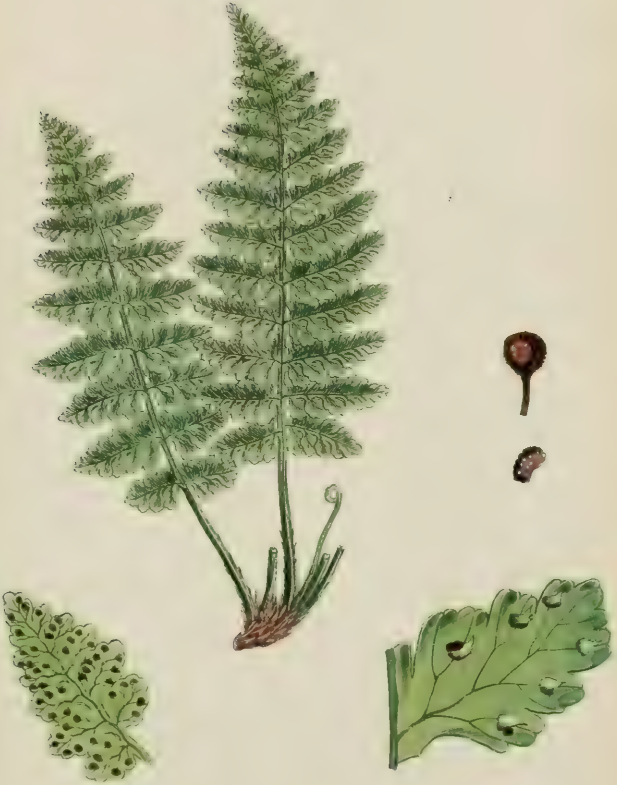
E. B. 1587 Cystopteris eu-fragilis, var. genuina. Brittle Bladder-Fern, var. *a*.



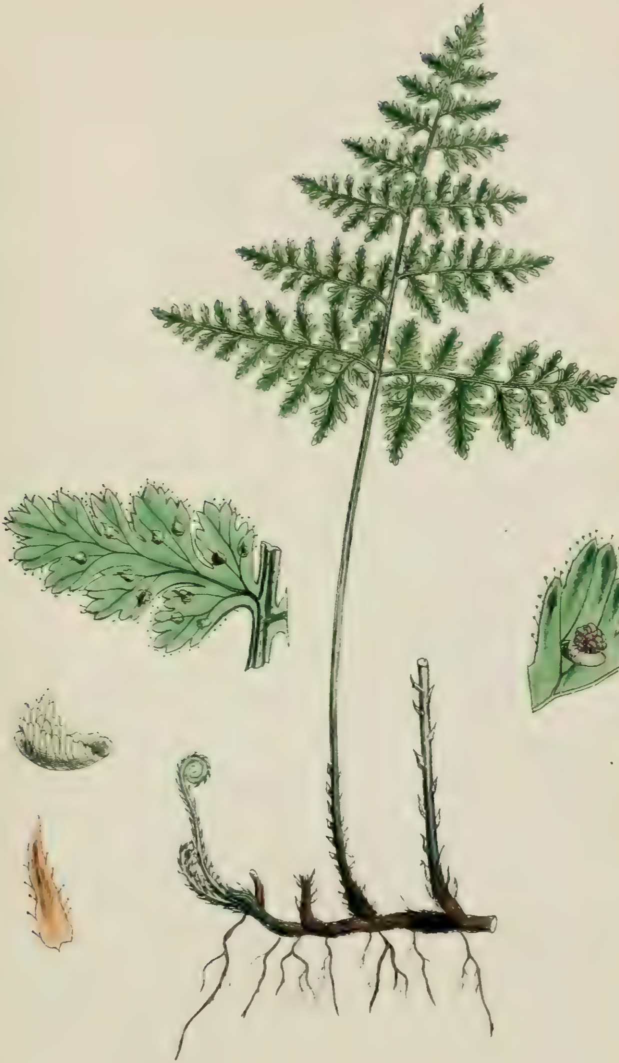
E. B. S. 2790. Cystopteris eu-fragilis, var. dentata. Brittle Bladder-Fern, var. β



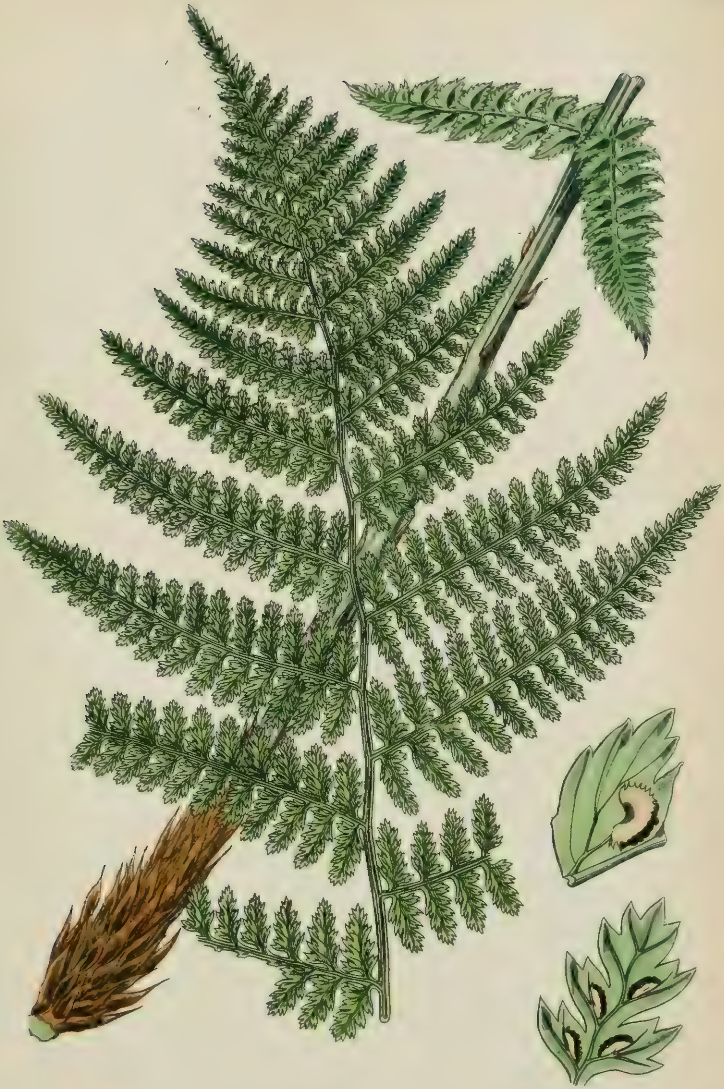
E. B 163. Cystopteris alpina, var. genuina. Alpine Bladder-Fern, var. *a*.



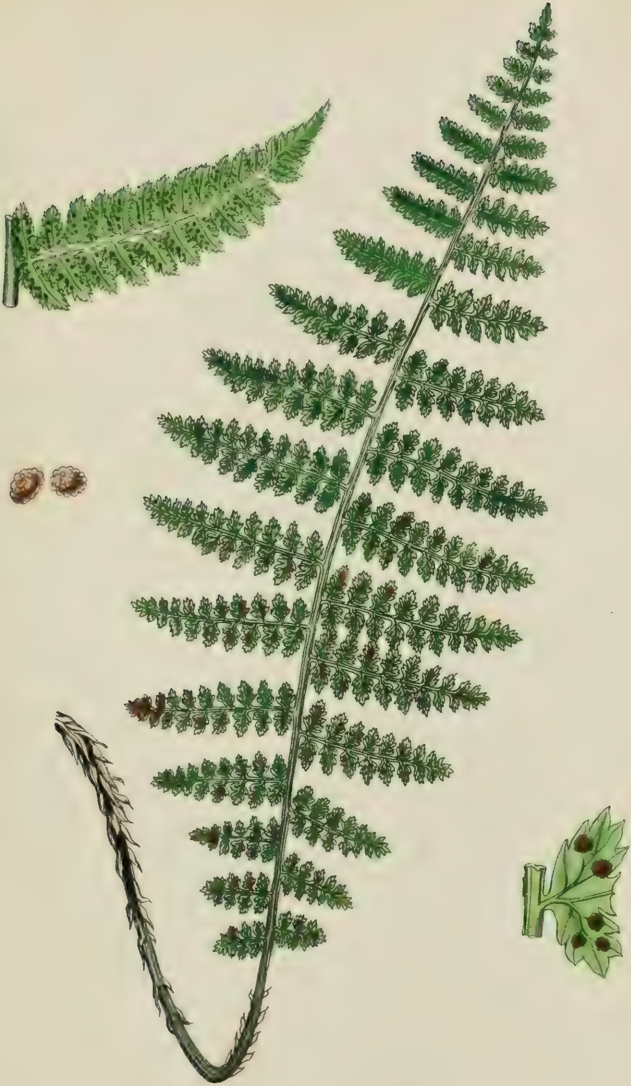
S. B. F. 22. Cystopteris alpina. var. Dickiana. Alpine Bladder-Fern. var. β.



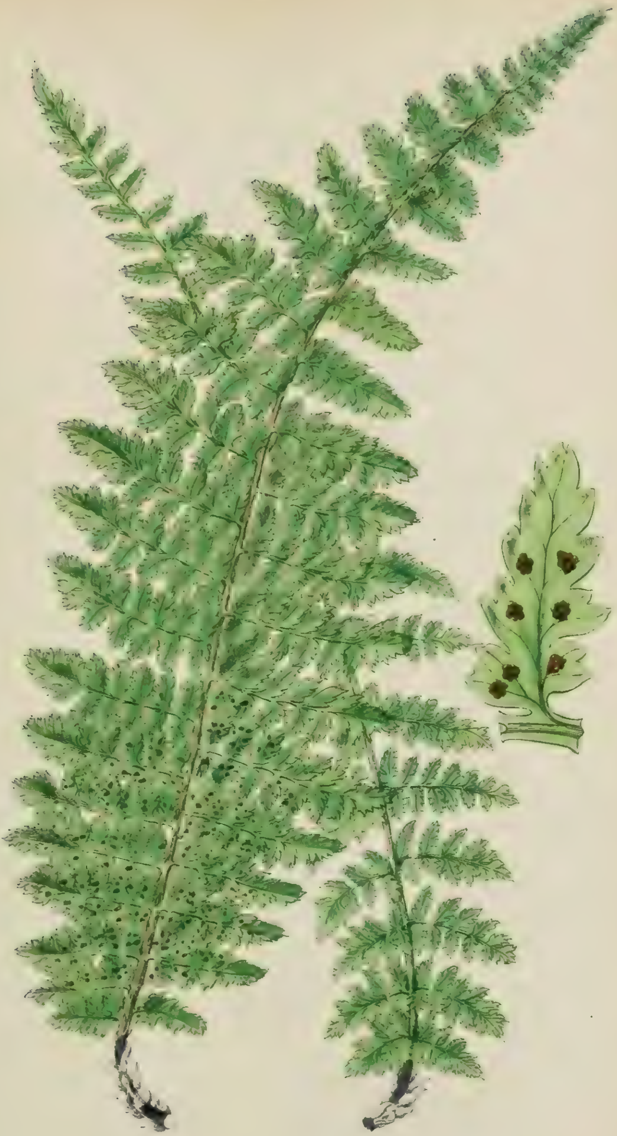
S. B. F. 24. Cystopteris montana. Mountain Bladder-Fern.



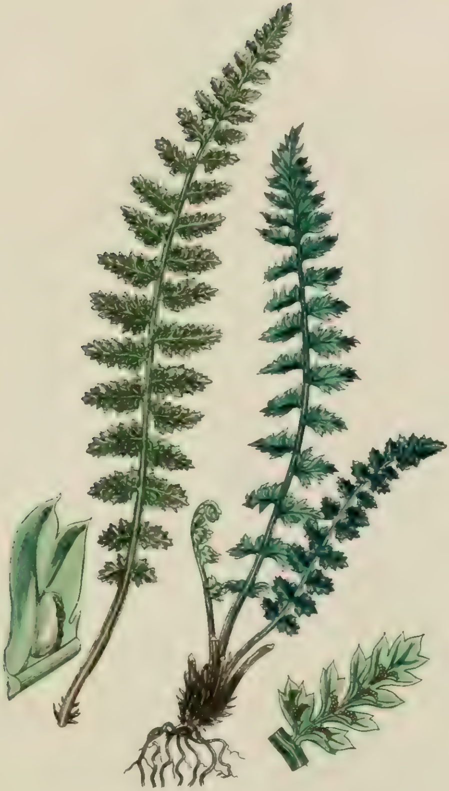
S. B. F. 25. Athyrium Filix-fœmina. Common Lady-Fern.



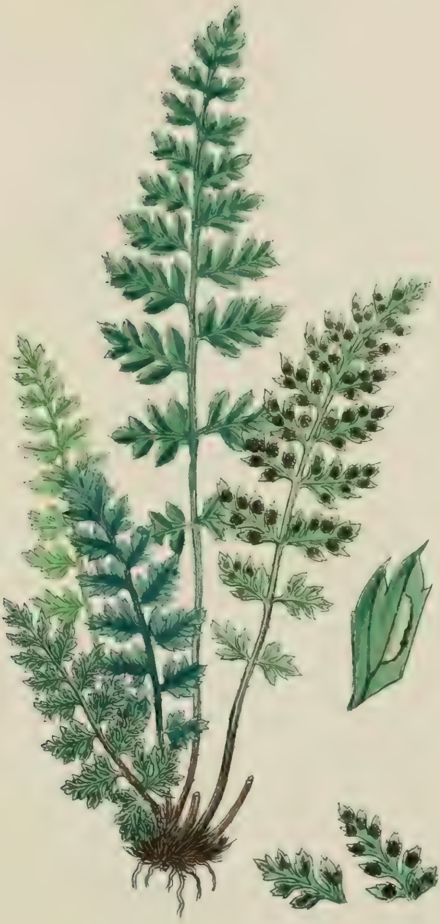
S. B. F. 49. Athyrium eu-alpestre. Alpine Lady-Fern.



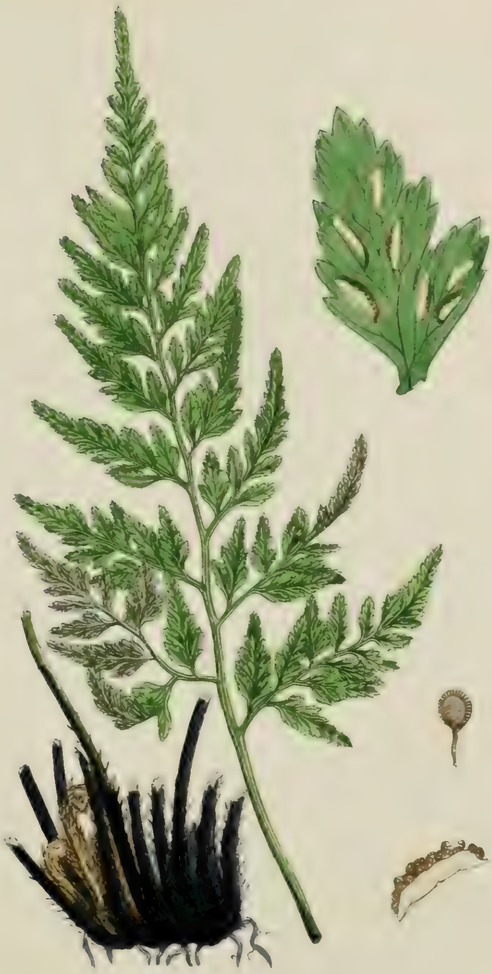
Athyrium alpestre, var. flexile. Dwarf Alpine Lady-Fern.



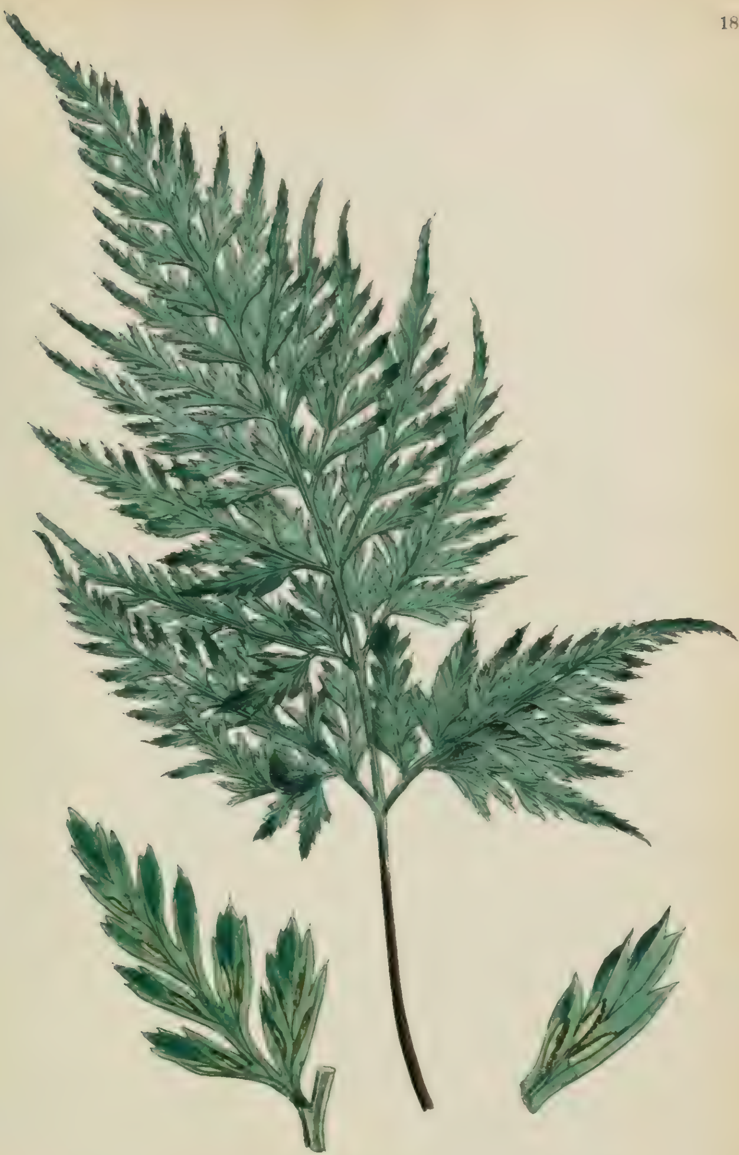
E. B. 2024. Asplenium fontanum. Smooth Rock Spleenwort.



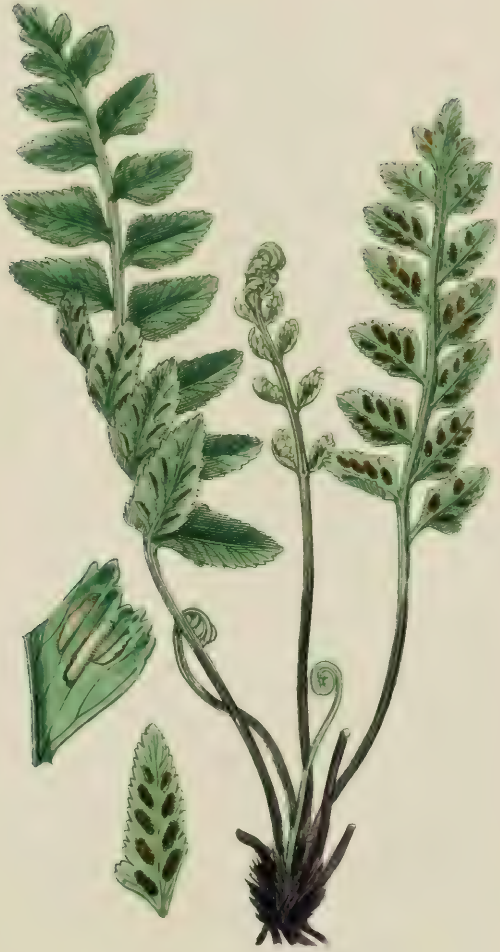
E. B. 240. Asplenium lanceolatum. **Lanceolate Spleenwort.**



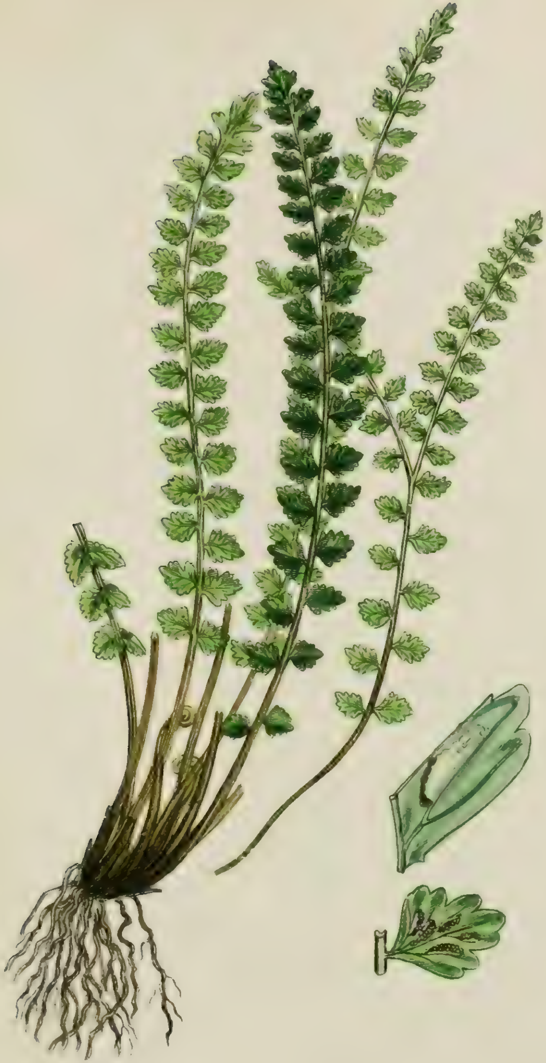
E. B. 1950. Asplenium Adiantum-nigrum, var. genuinum. Black Spleenwort.



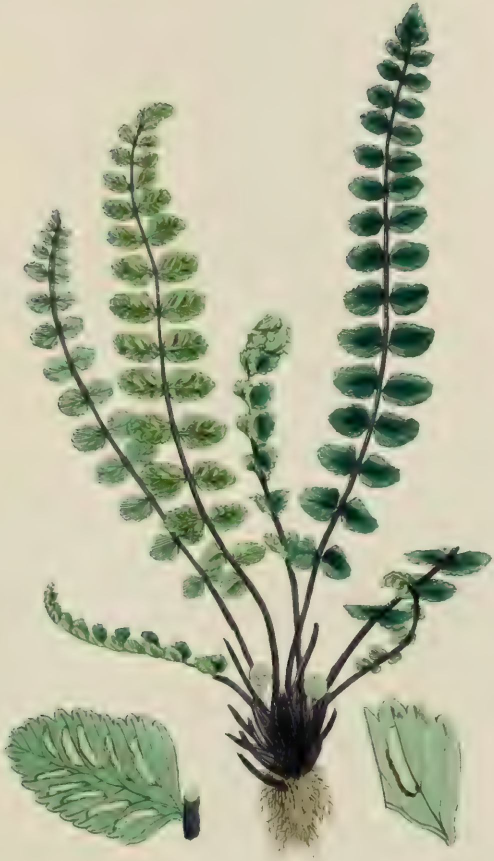
Asplenium Adiantum-nigrum, var. acutum. Black spleenwort var. δ



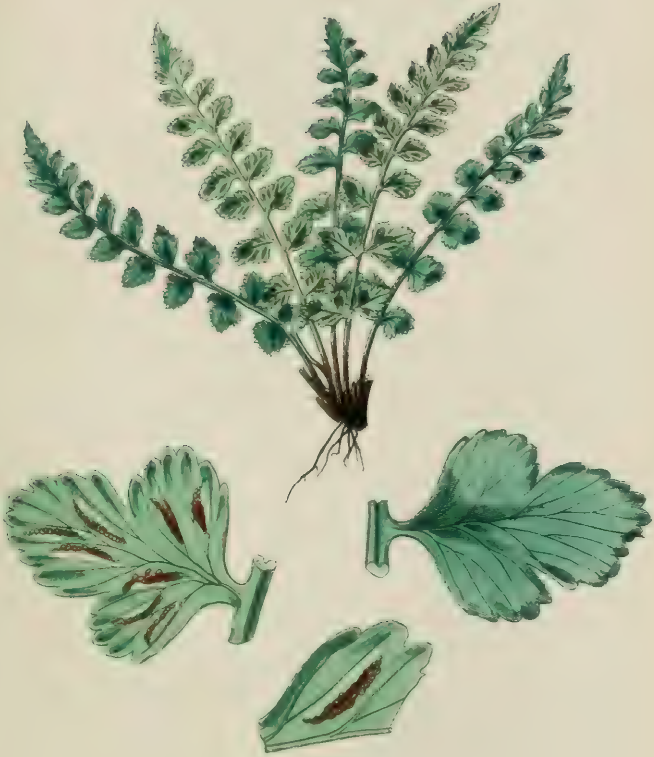
E. B. 392. Asplenium marinum. Sea Spleenwort.



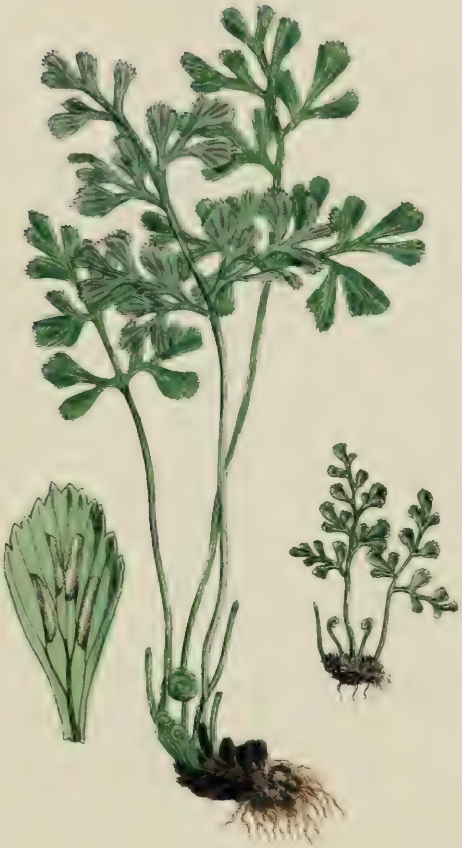
E. B. 2257. Asplenium viride. Green Spleenwort.



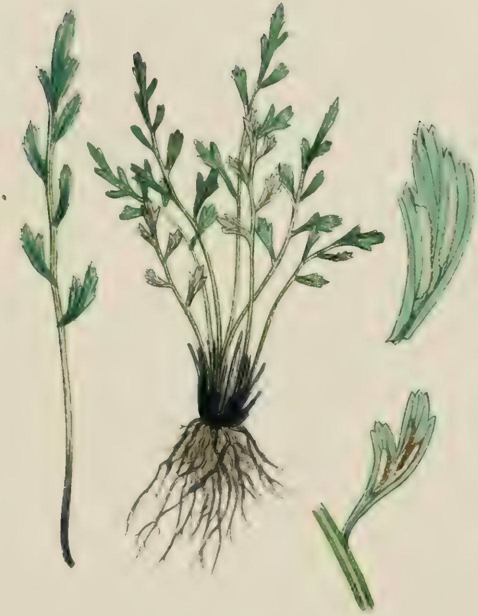
E B 576 Asplenium Trichomanes. Maidenhair Spleenwort.



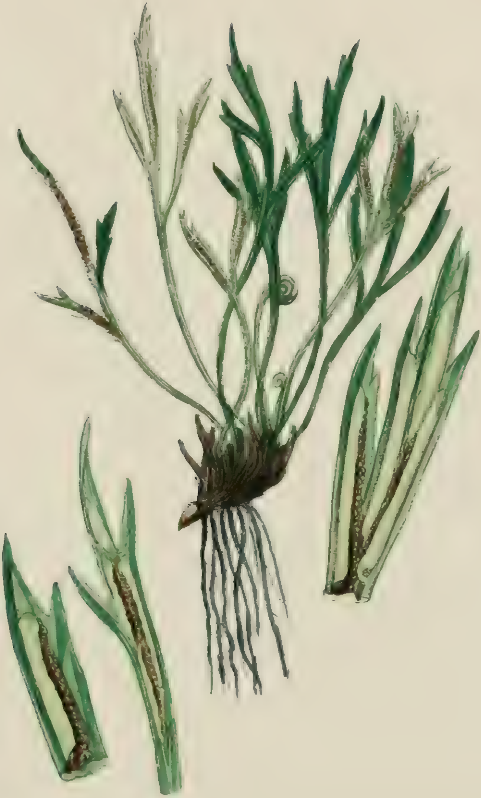
Asplenium Clermontæ. Lady Clermont's Spleenwort.



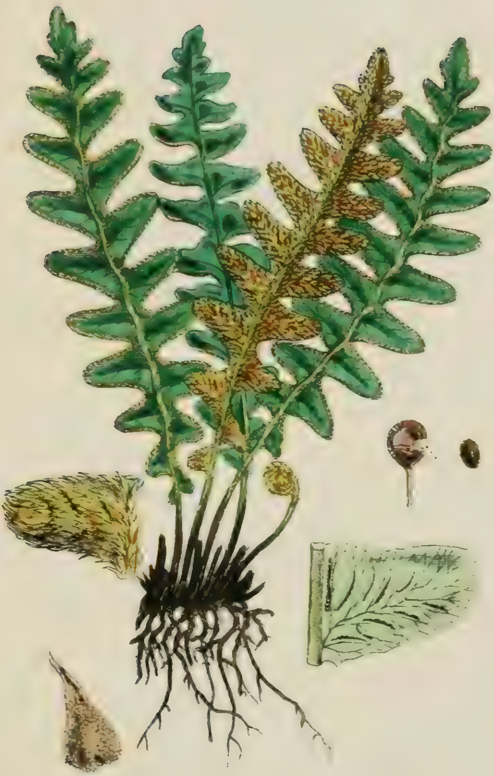
E. B. 150. Asplenium Ruta-muraria. Wall-Rue.



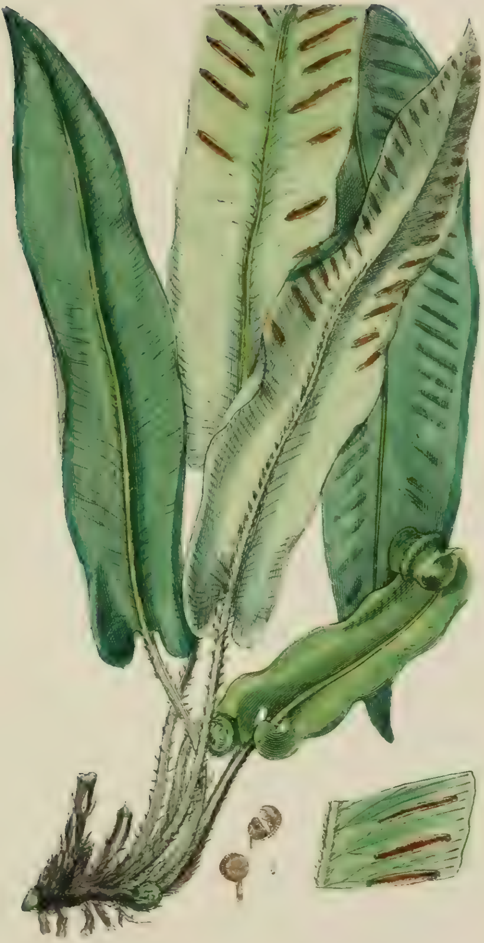
E. B. 2258. Asplenium Germanicum. Alternate-leaved Spleenwort.



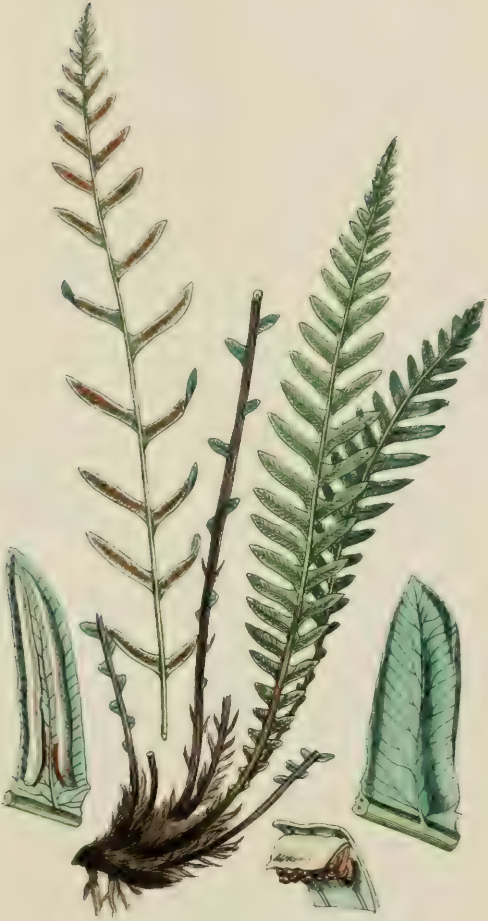
E. B. 1017. Asplenium septentrionale. Forked Spleenwort.



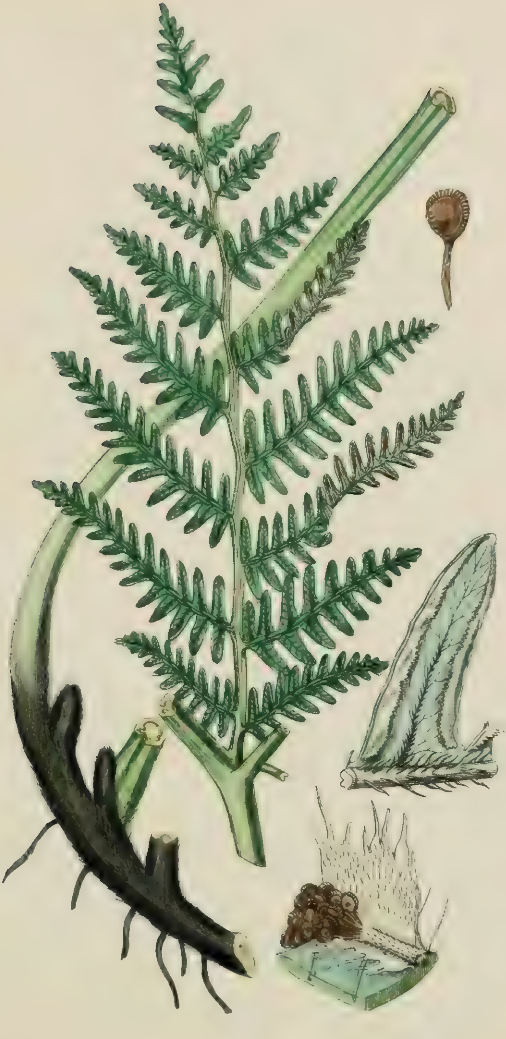
E. B. 1244. Ceterach Officinarum. Scaly Spleenwort.



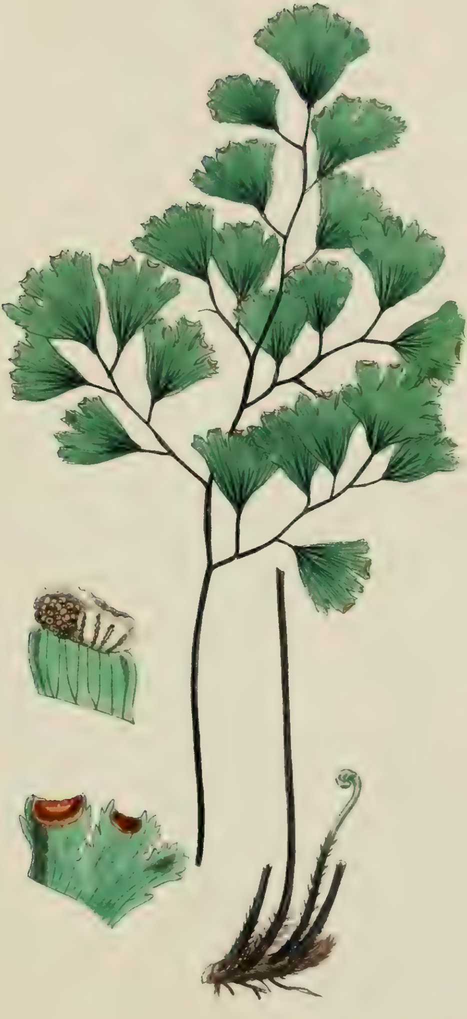
E. B. 1150. Scolopendrium vulgare. Hart's-tongue.



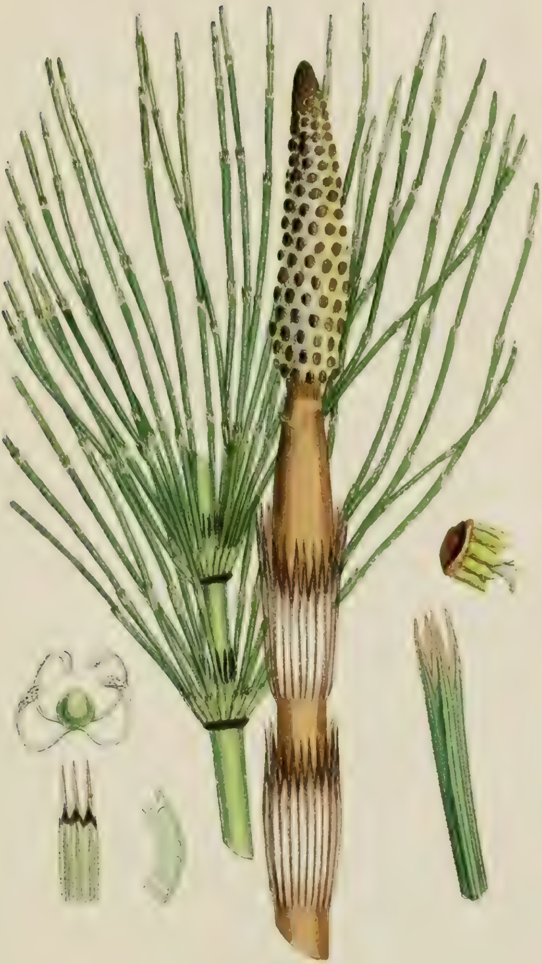
Lomaria Spicant.   Hard Fern.



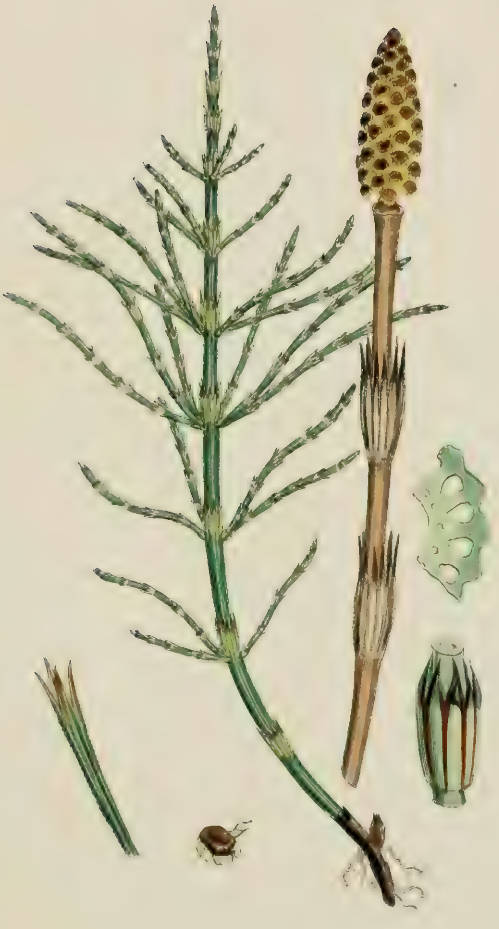
E. B. 1679.   Pteris aquilina.   Bracken.



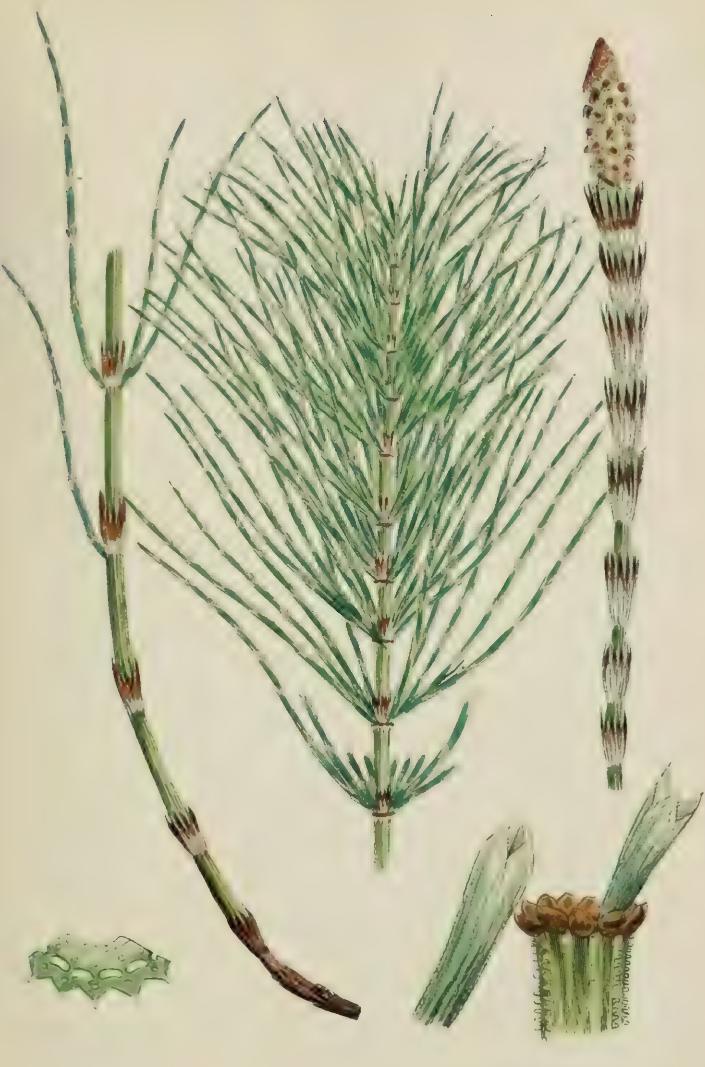
E. B. 1564. Adiantum Capillus-Veneris. Maiden hair.



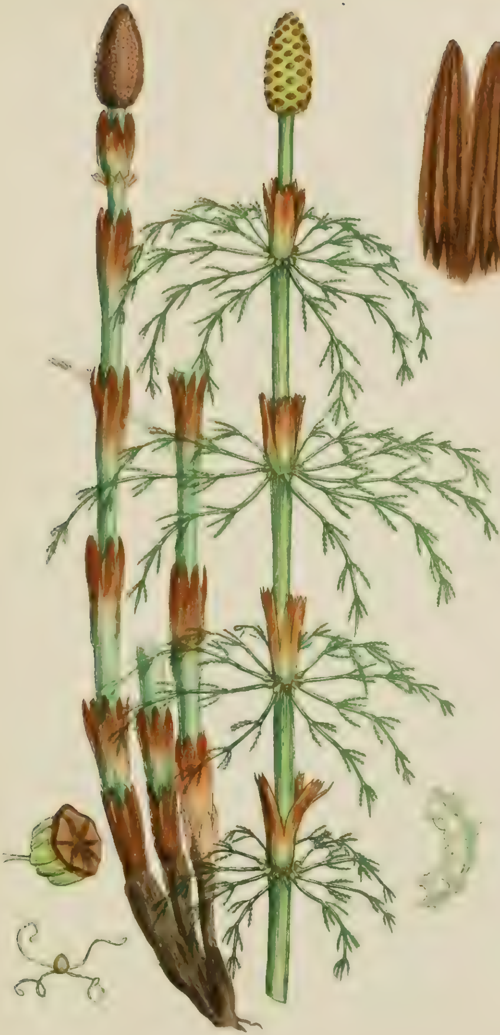
E.B. 2022. Equisetum maximum.



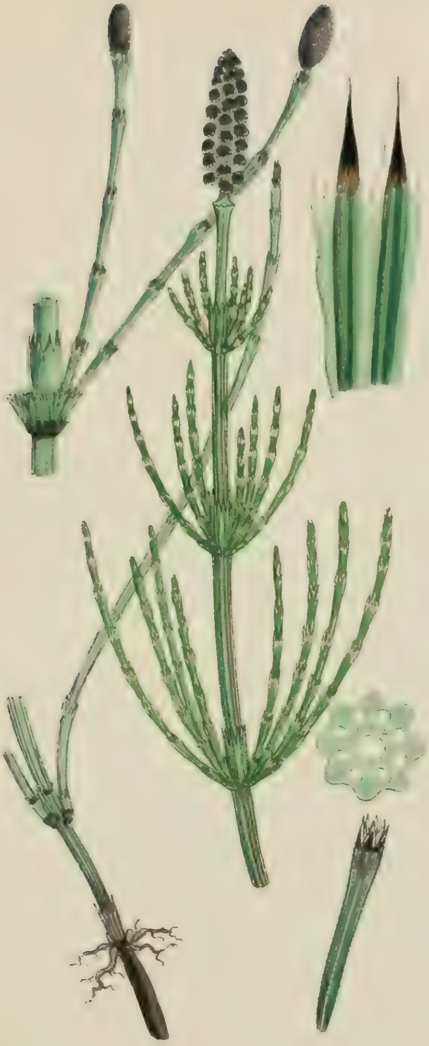
E.B. 2020. Equisetum arvense.



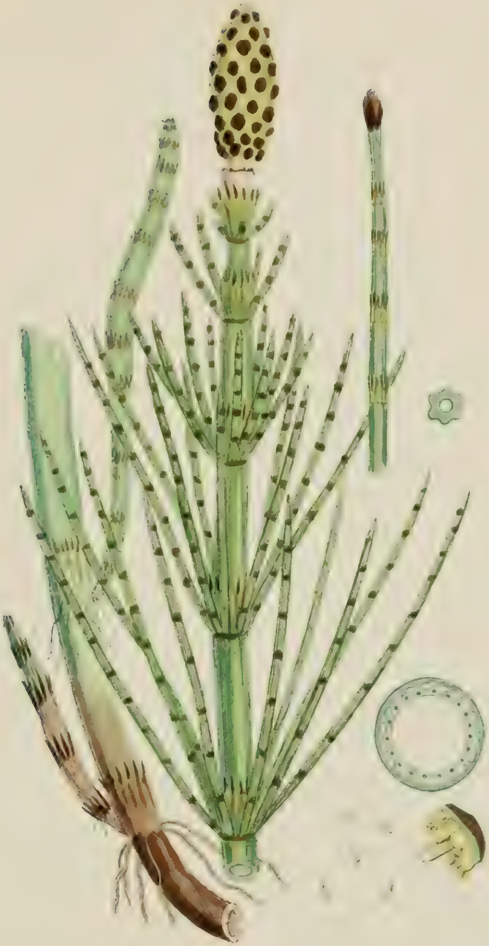
E.B.S. 2777. Equisetum pratense.



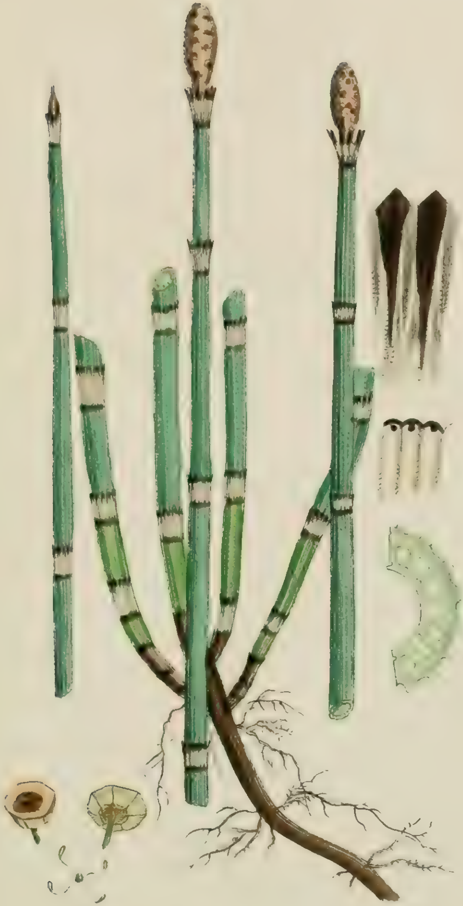
E.B. 1871. Equisetum sylvaticum.



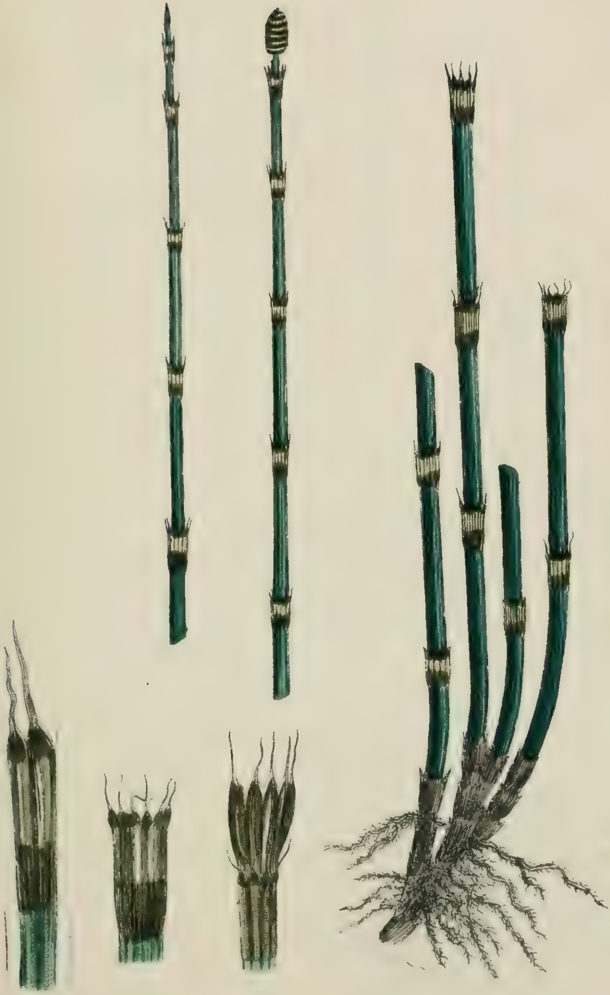
E.B. 2021. Equisetum palustre.



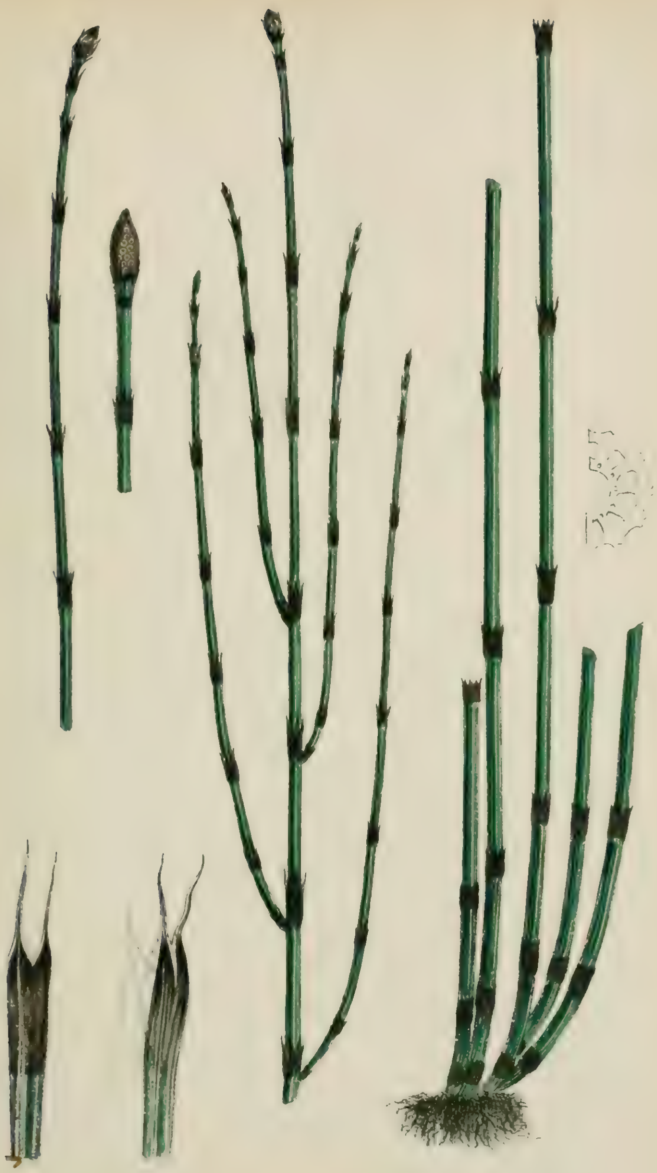
E.B. 929. Equisetum limosum.



E.B. 915. Equisetum eu-hyemale.

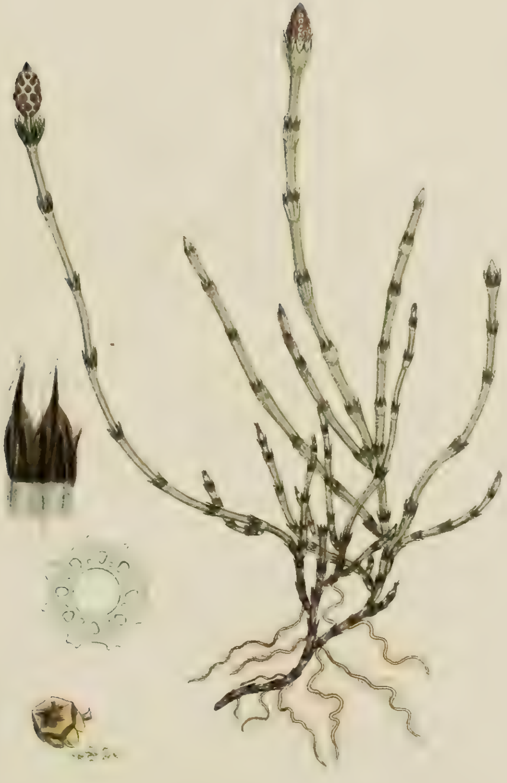


Equisetum Moorei.



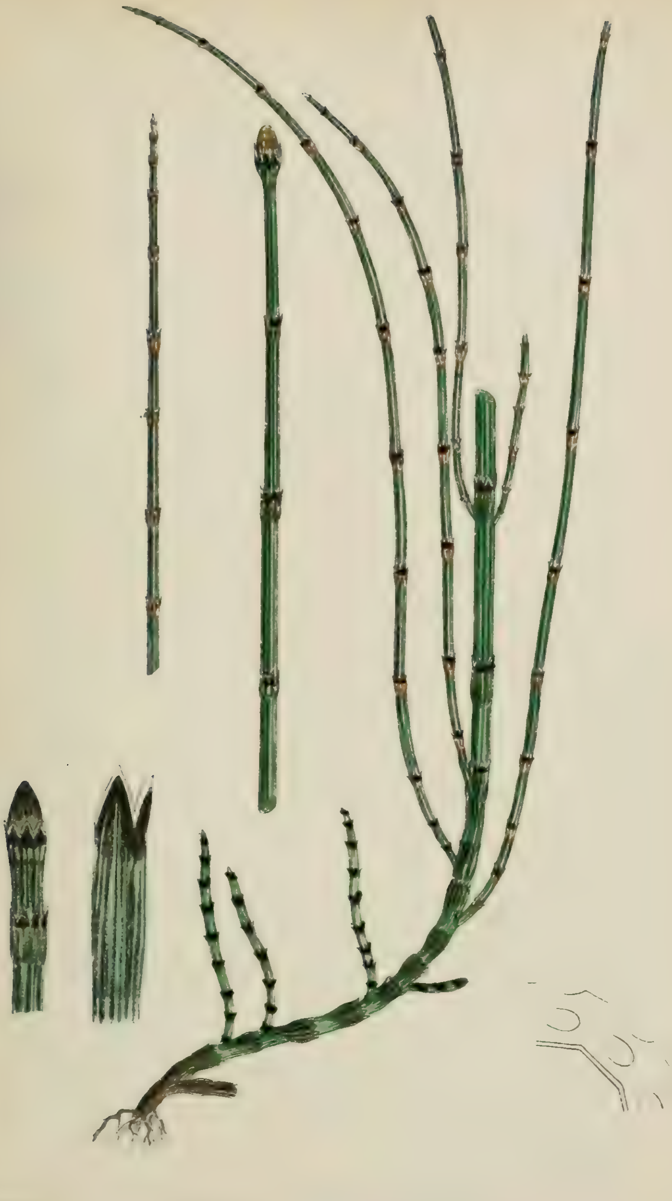
S.B.F.A. 9.

Equisetum trachyodon.

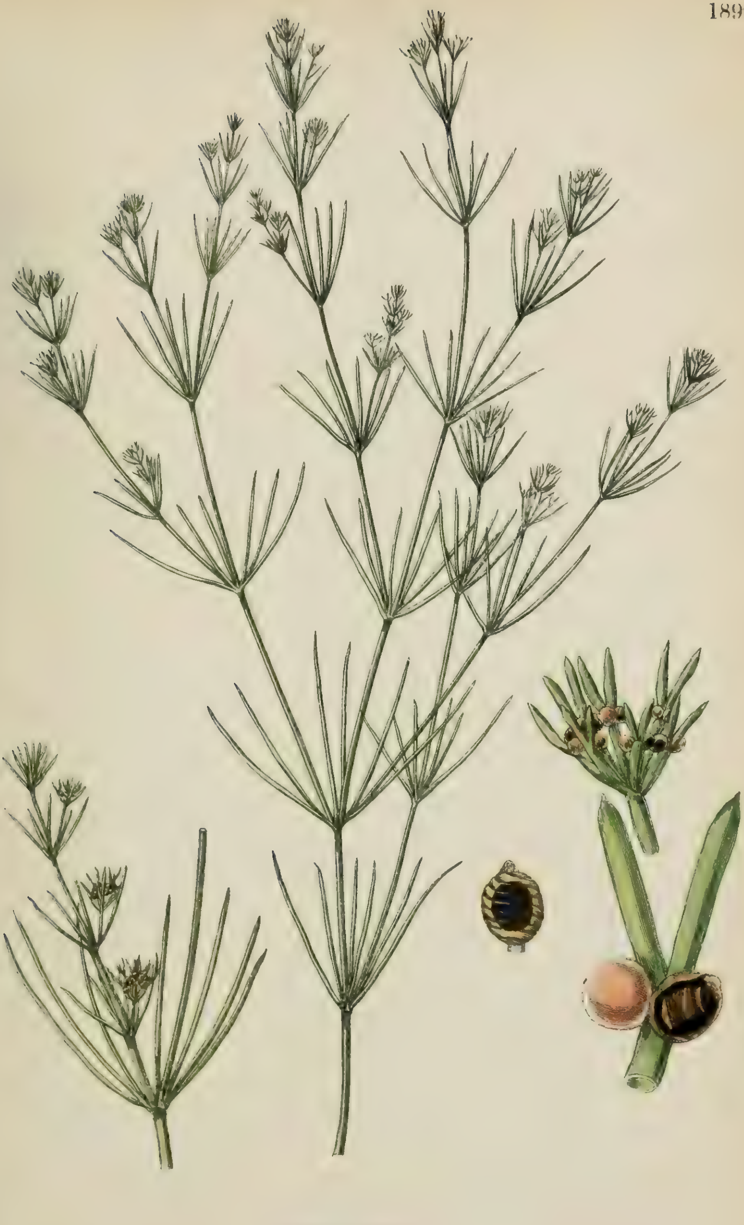


S.B.F.A. 10.

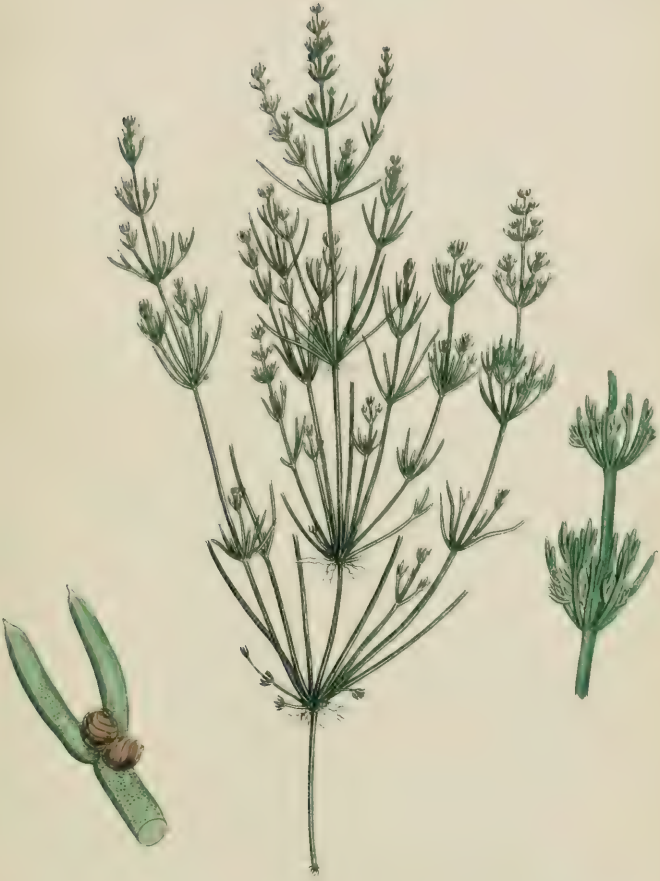
Equisetum variegatum var. Wilsoni.



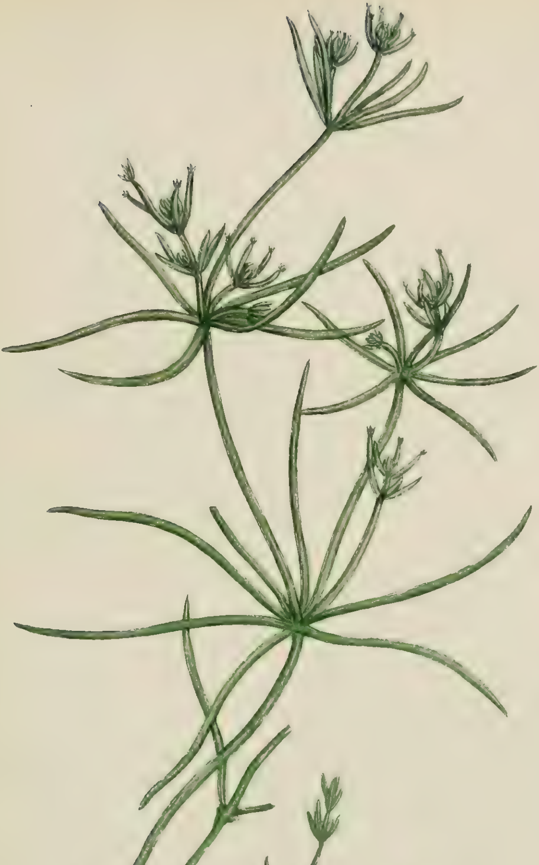
S.B.F.A.10. Equisetum variegatum var. Wilsoni.



Nitella Flexilis.

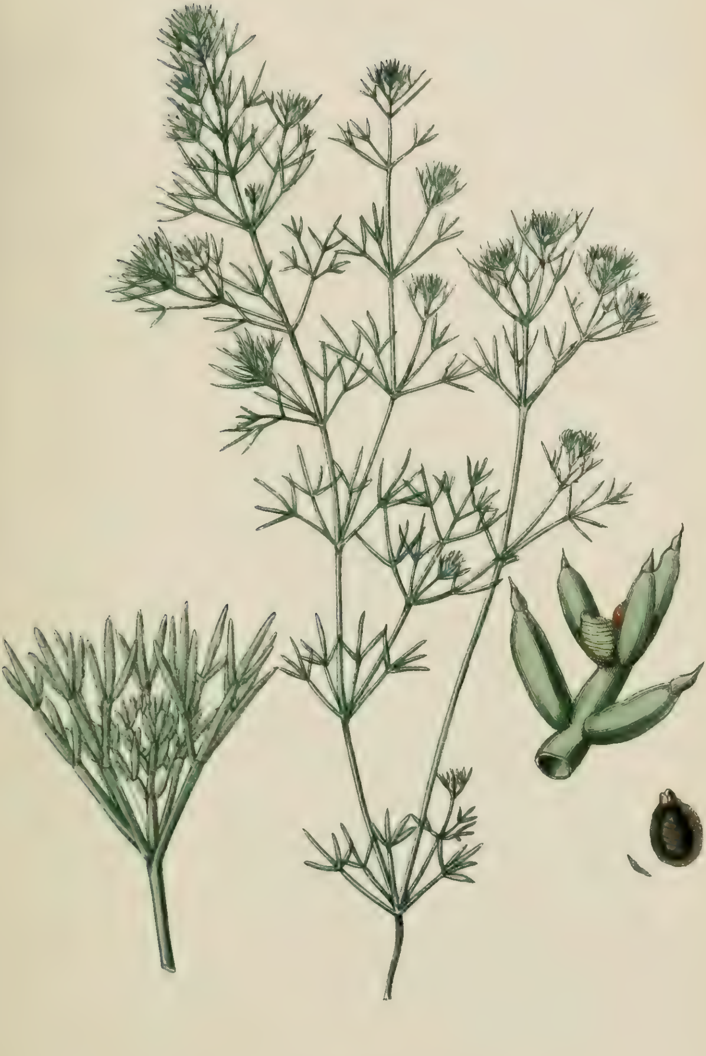


Nitella syncarpa var. opaca.

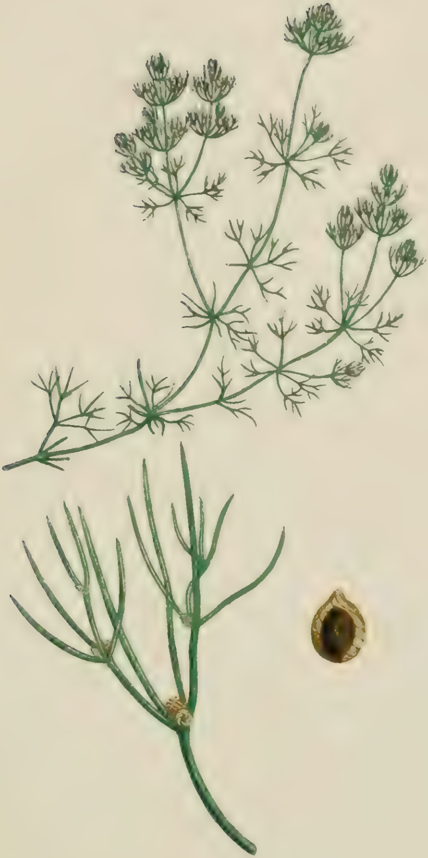


E.B. 1855.

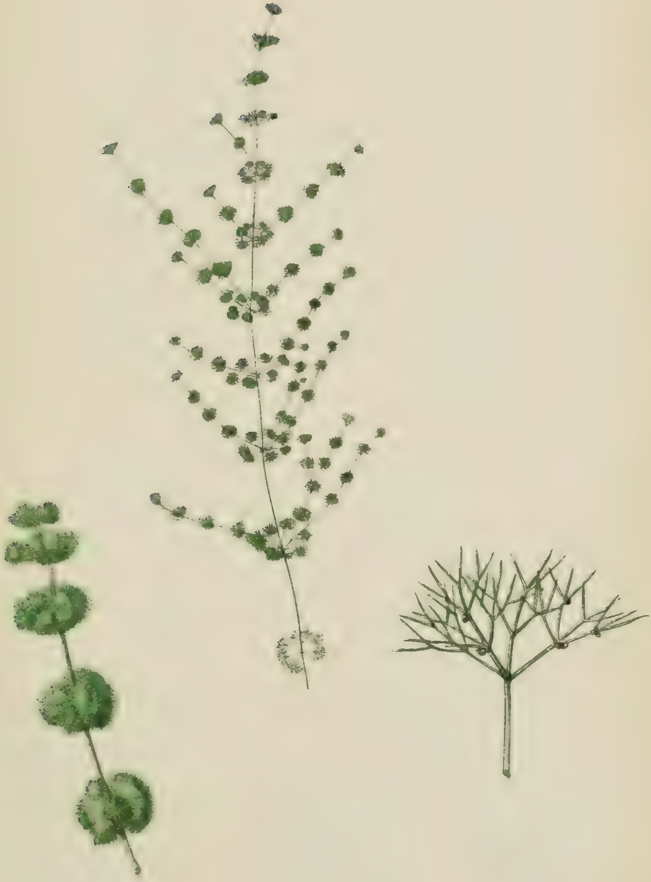
Nitella translucens.



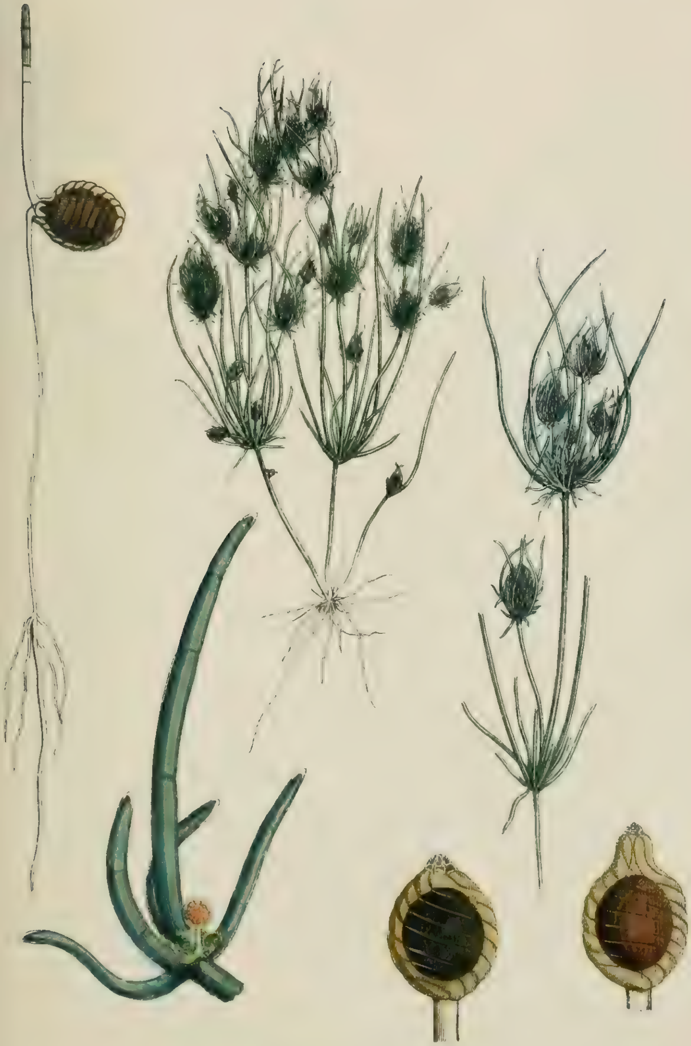
Nitella mucronata.



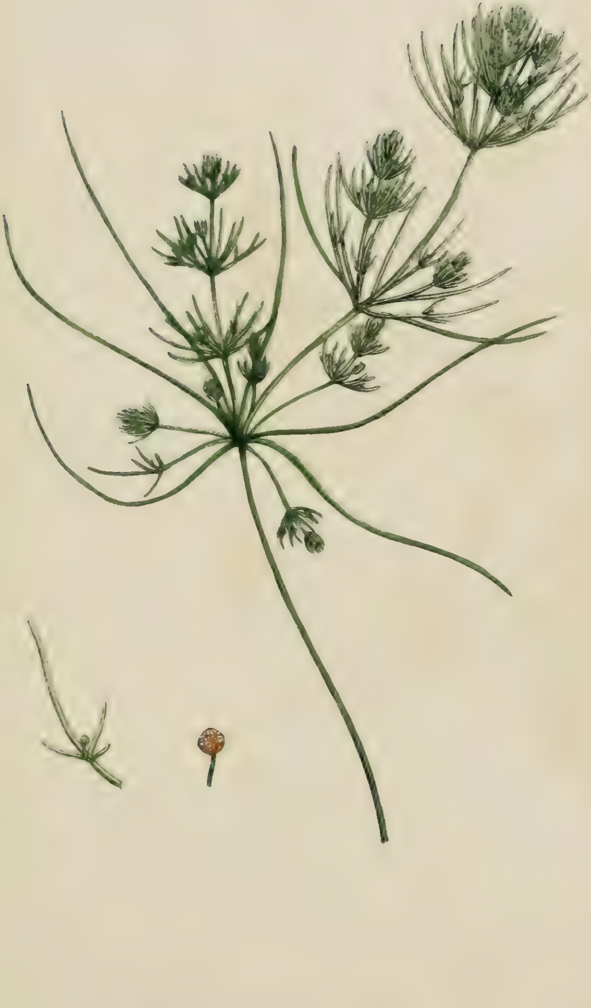
E.B. 2140. Nitella gracilis.



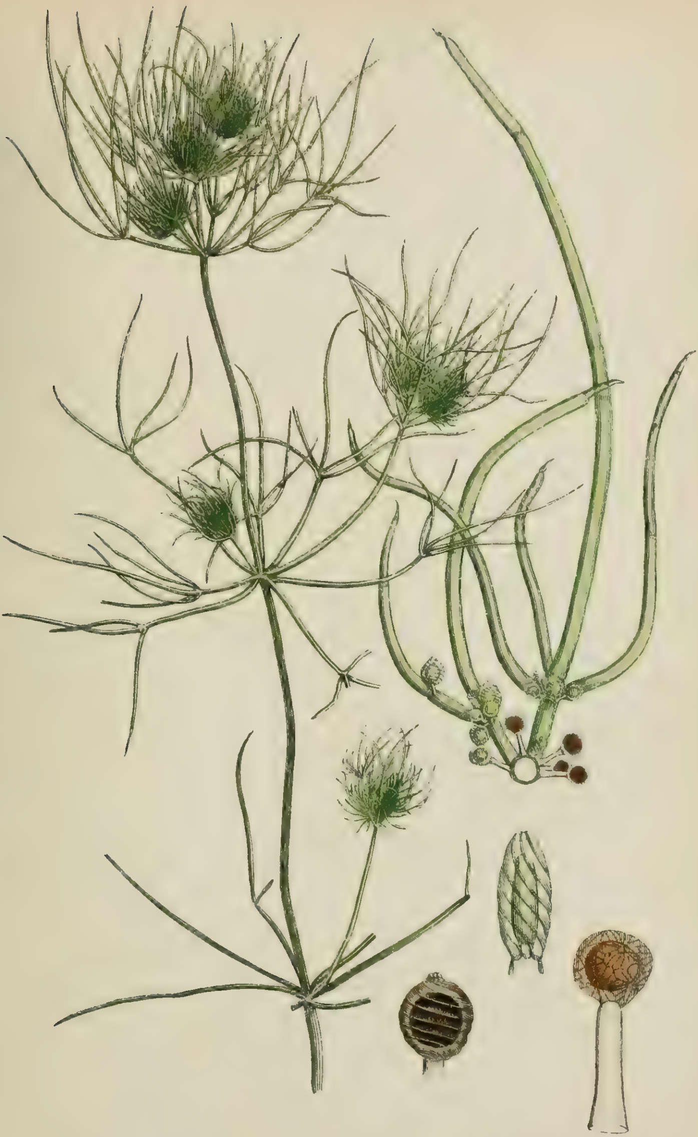
Nitella tenuissima.



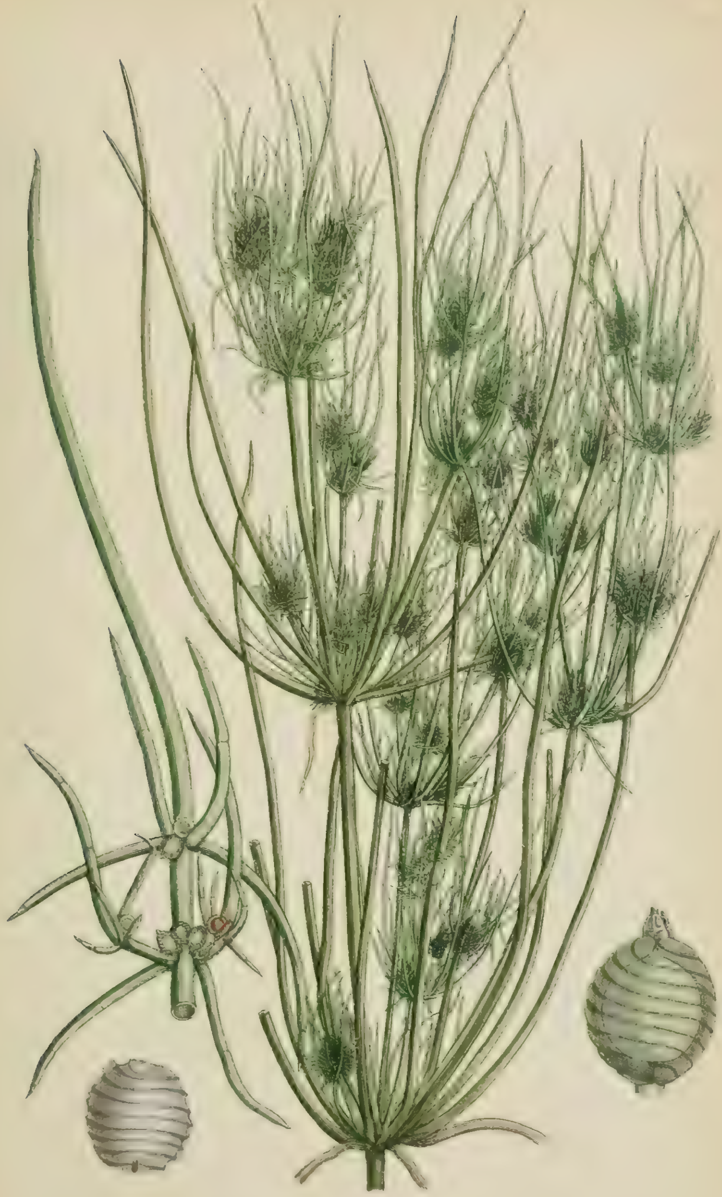
Nitella glomerata var. α genuina.



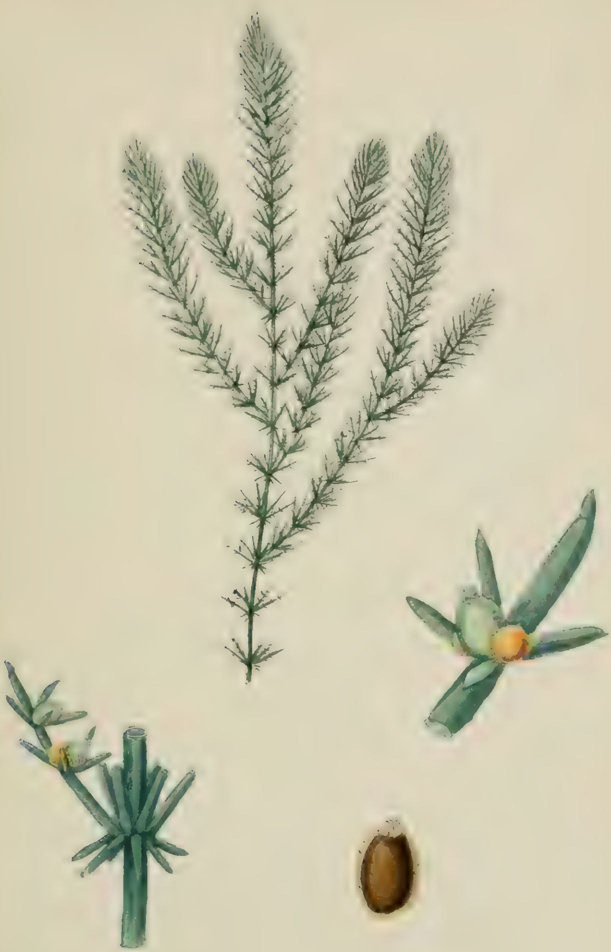
E.B. 1703. Nitella glomerata var. Smithii



Nitella intricata.

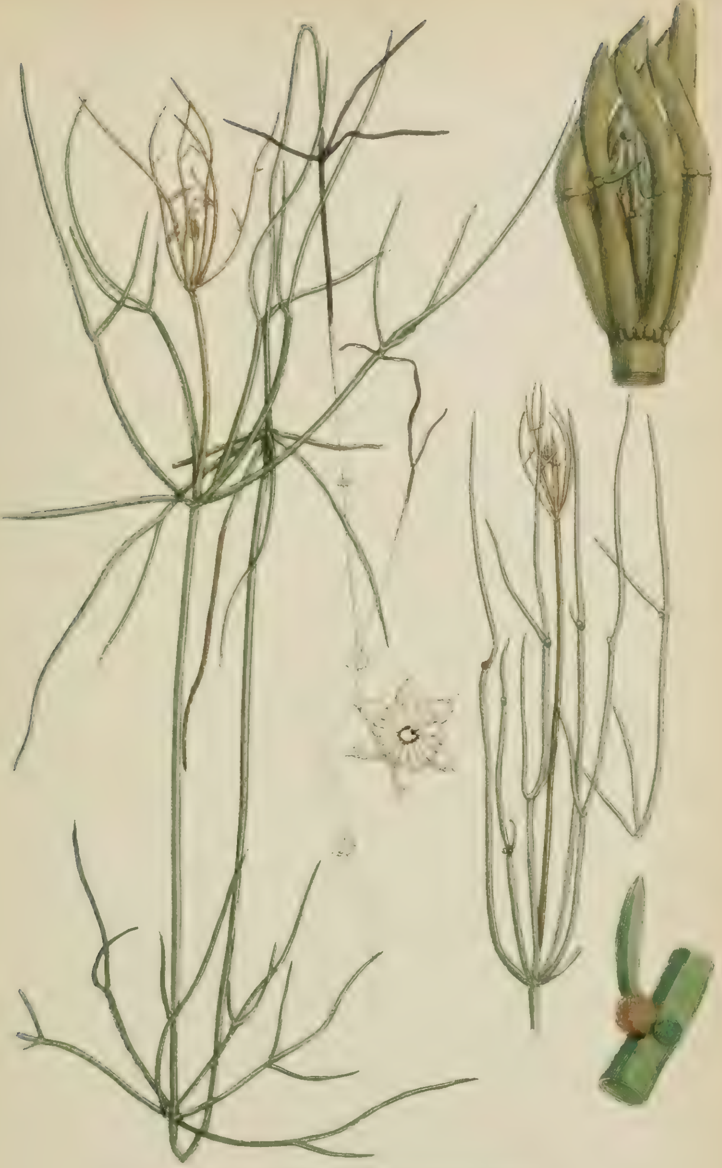


Nitella intricata var. prolifera.

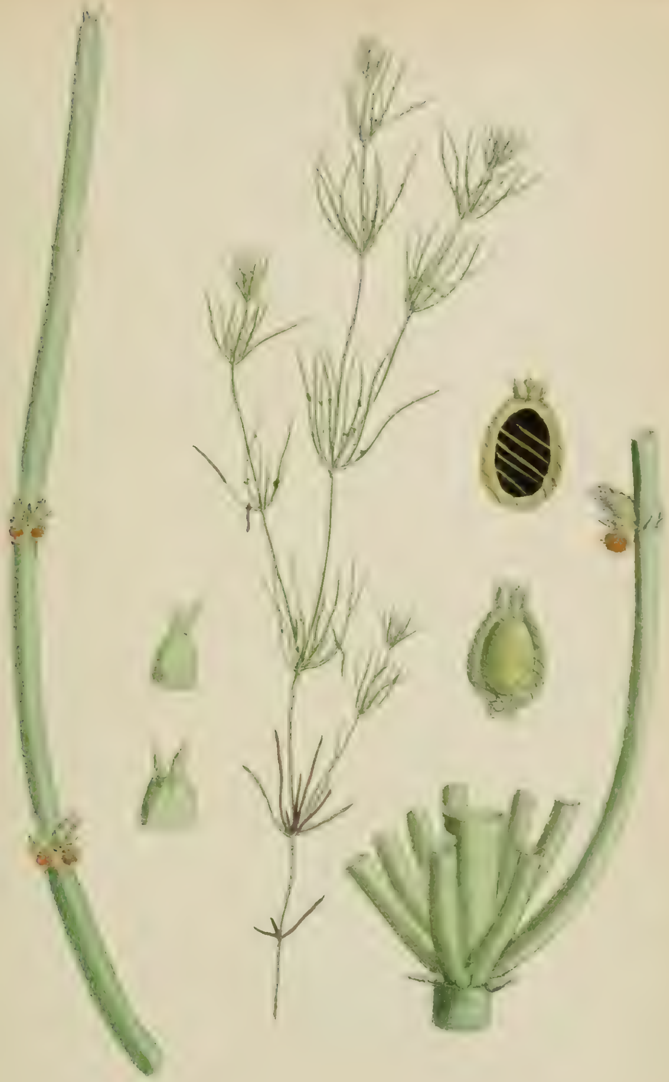


Chara alopecuroidea. Foxtail chara.

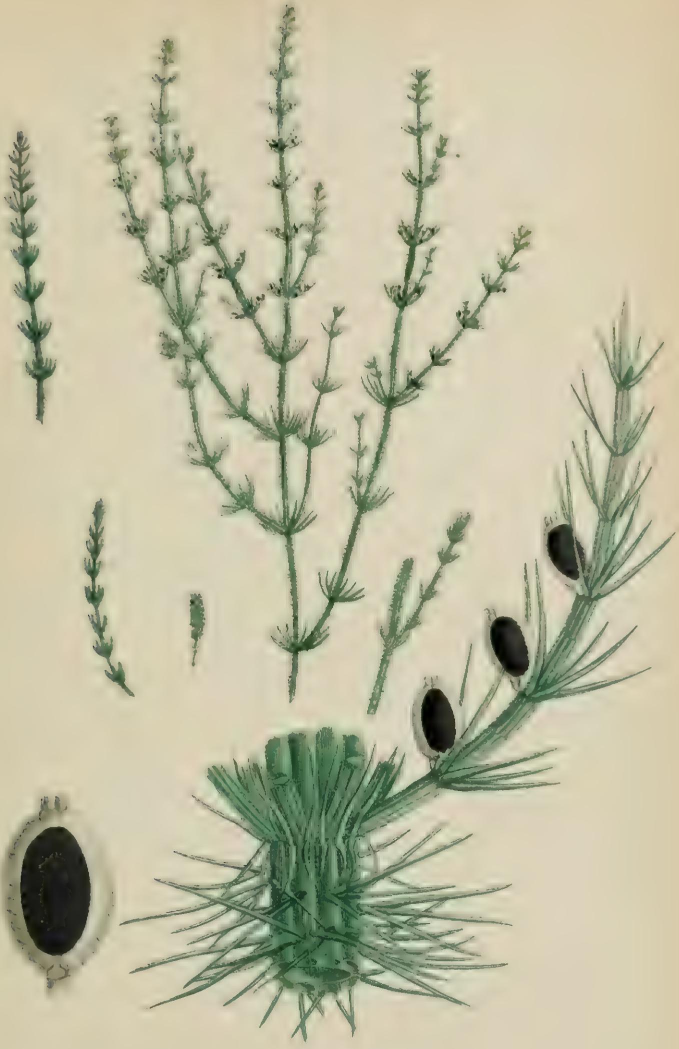
1910.



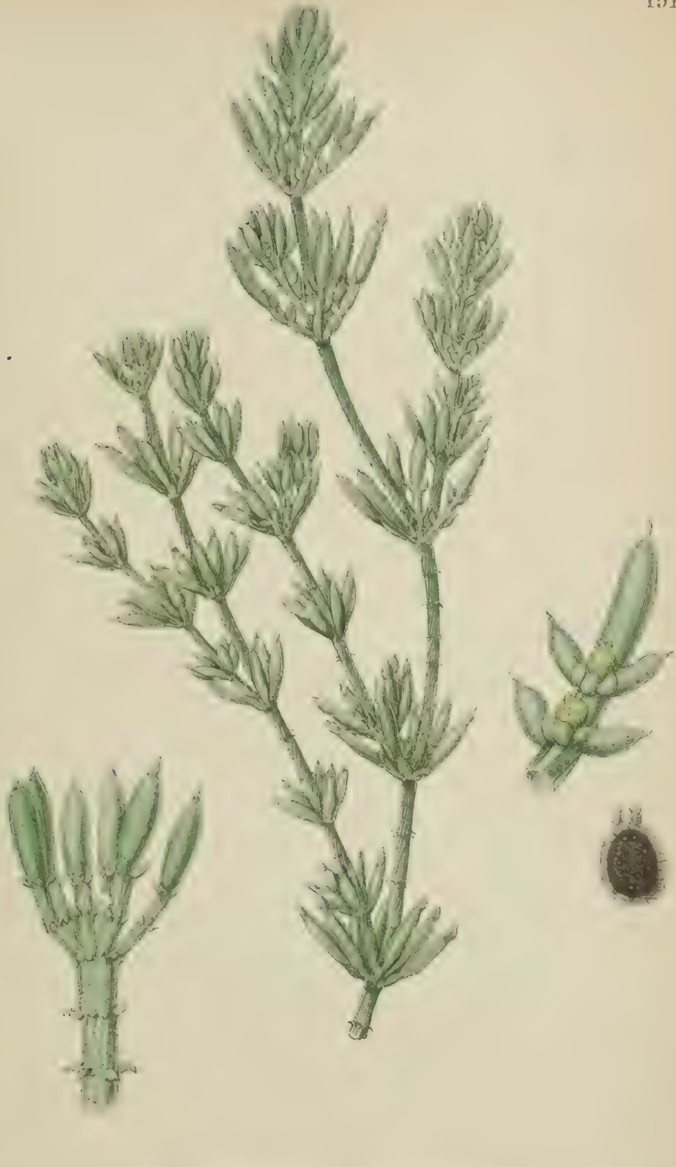
Chara stelligera. Starbearing chara.



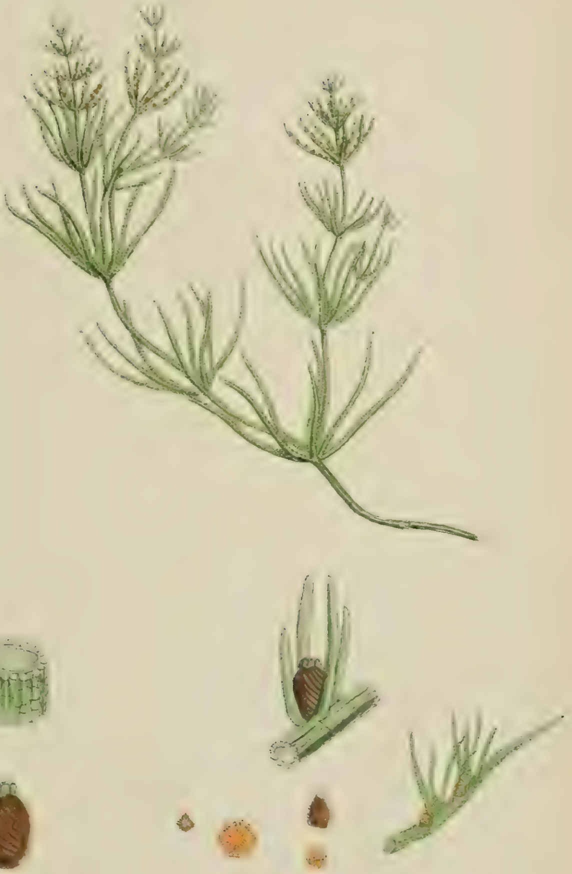
Chara Braunii. Braun's chara.



Chara crinita. Bearded chara.

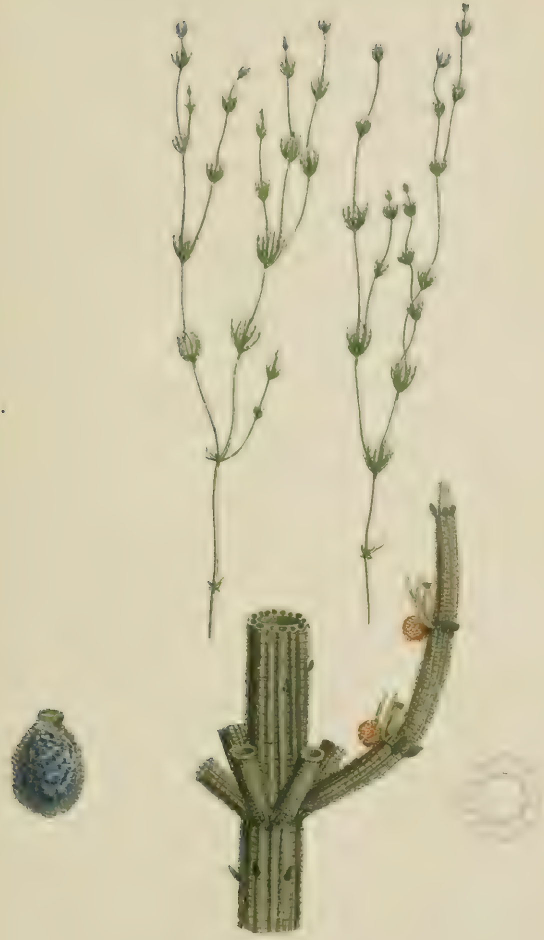


Chara tomentosa. Tomentose chara.

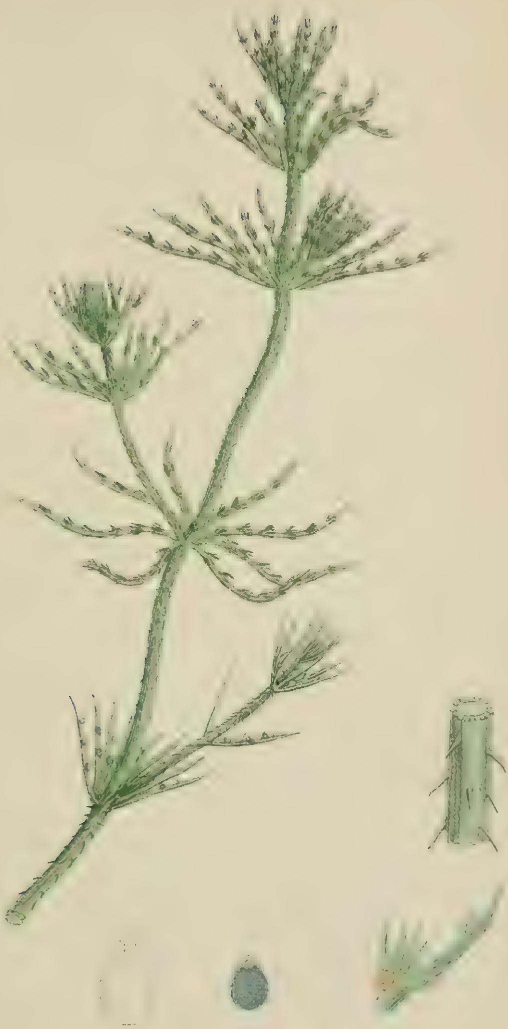


E. B. 336.

Chara foetida, var. *a*. genuina. Fetid chara.



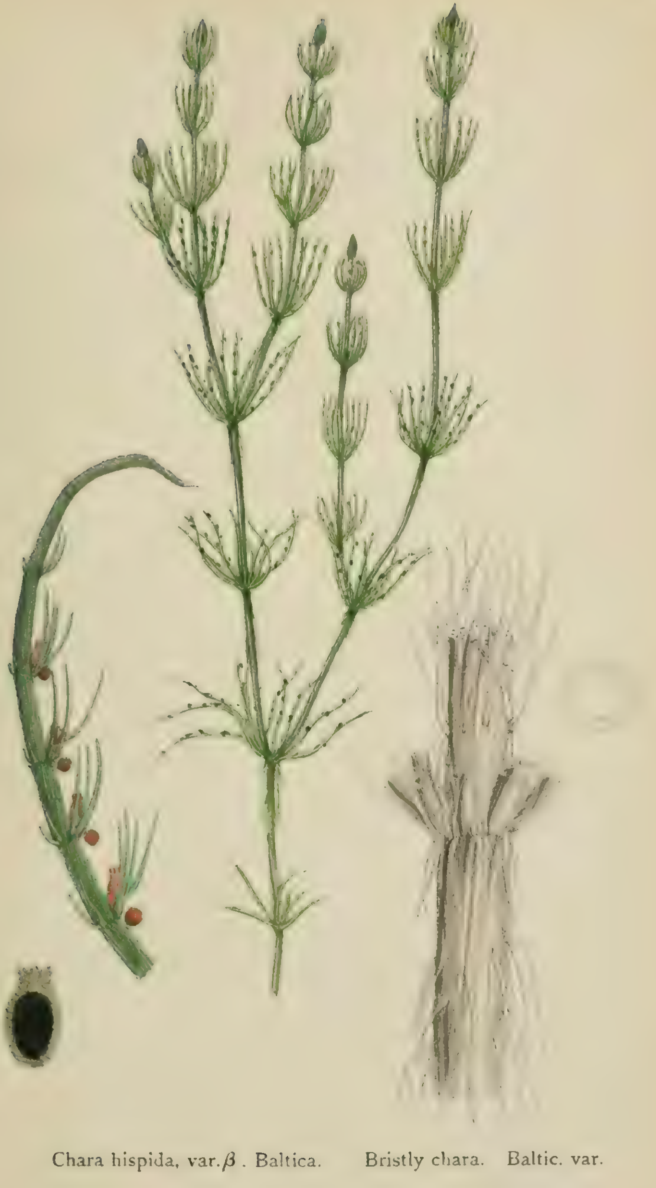
Chara foetida, var. β. contraria. Fetid chara.



E. B. 463.

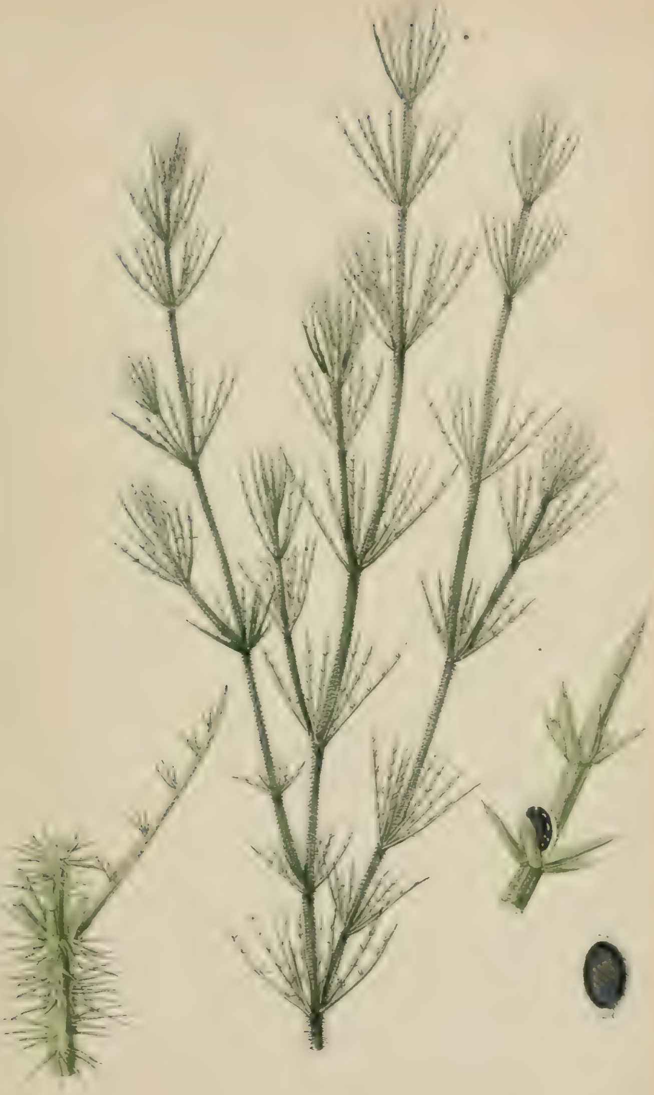
Chara hispida, var. *α.* genuina.   Bristly chara.

1917.

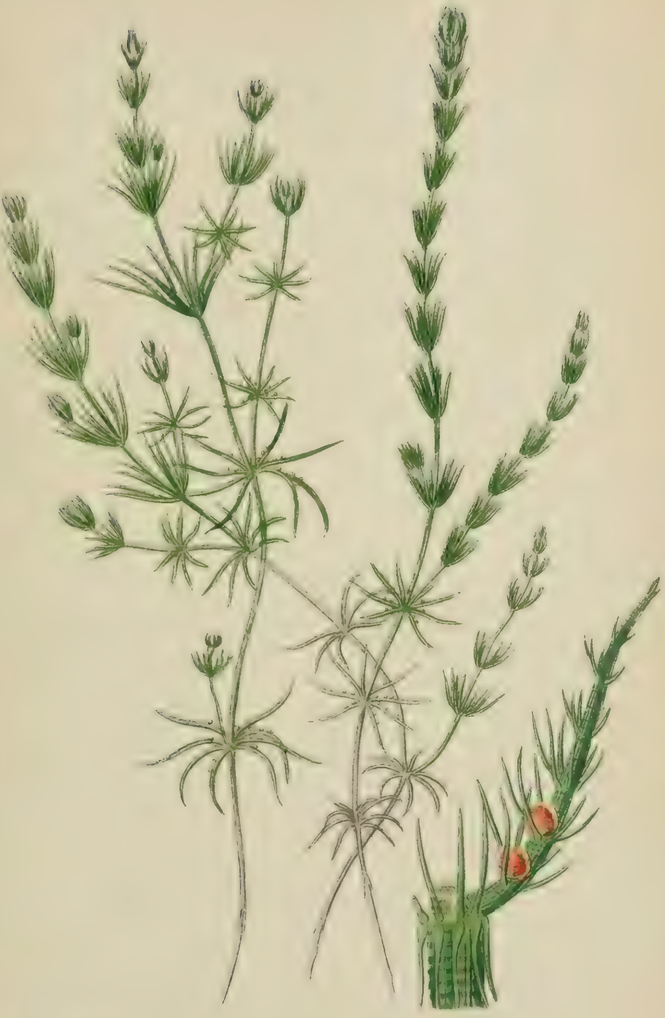


Chara hispida, var. β. Baltica. Bristly chara. Baltic. var.

1918.

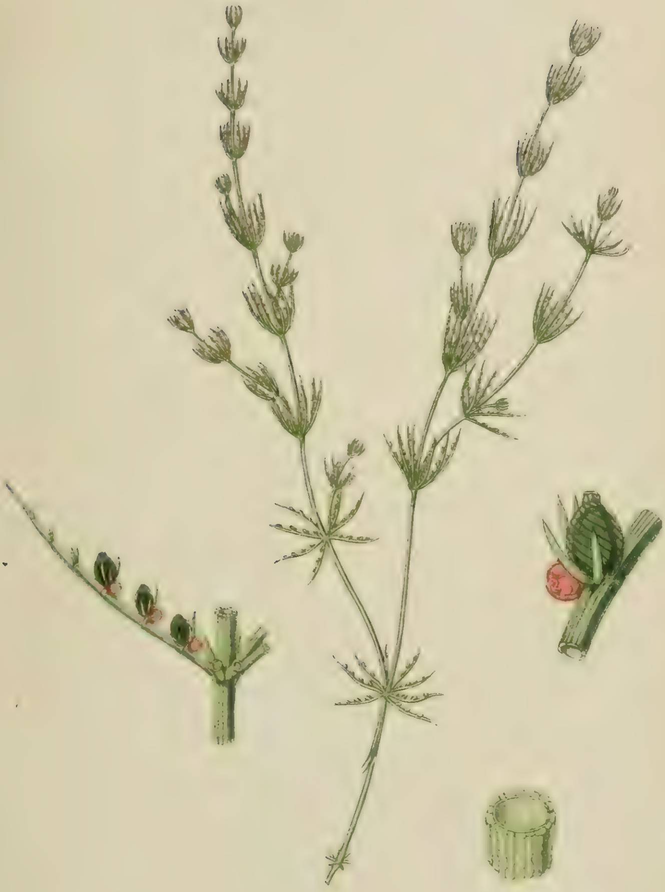


Chara hispida, var. γ pseudo-crinita.   Bristly chara, var. γ.

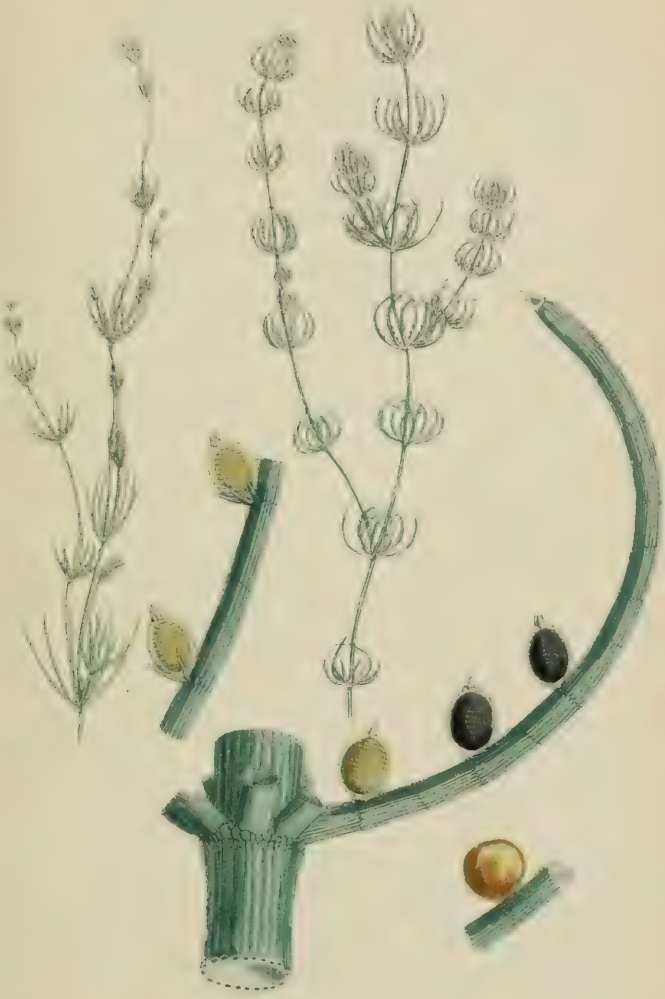


E. B. S. 2738.

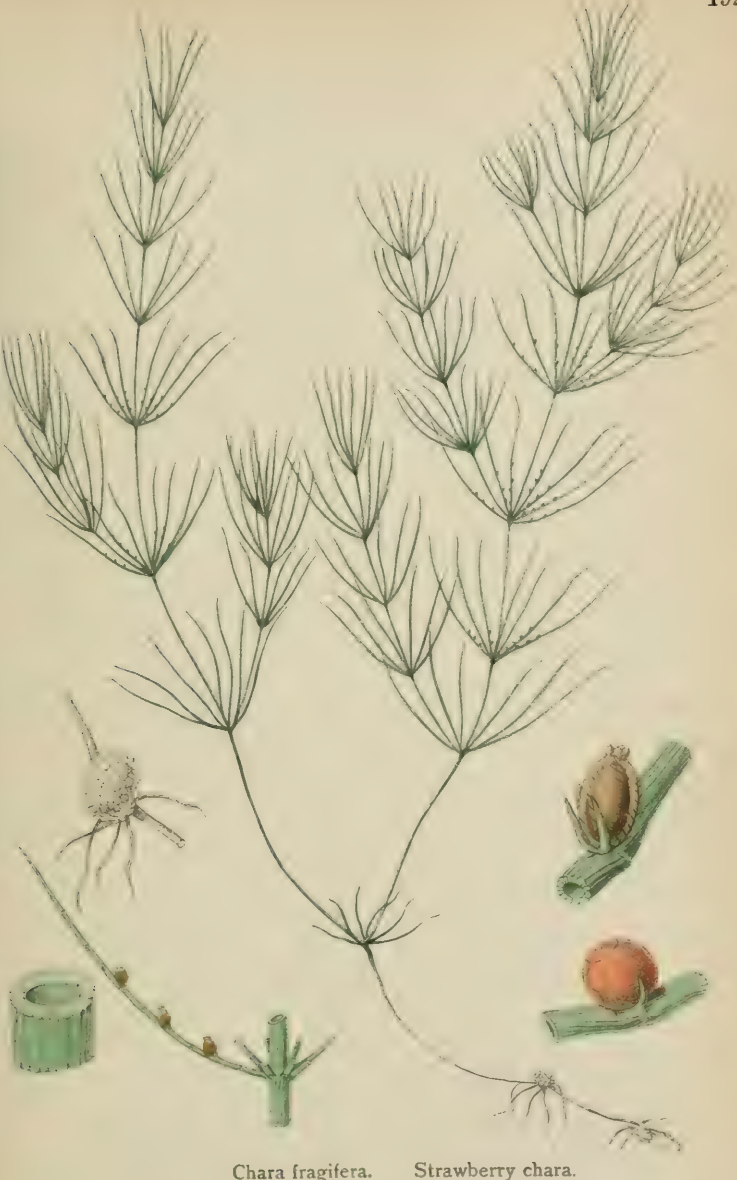
Chara aspera. Rough chara.



Chara fragilis, var. genuina. Fragile chara.



Chara fragilis, var. β . connivens. Fragile chara, var. β.



Chara fragifera. Strawberry chara.